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NSF 85-325

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NSF 85-325

I

Contents

	Page
General Notes	iv

Section:

	Page
A. Technical Notes	1
B. Statistical Tables	13
C. Reproduction of Survey Instruments	72

II

General Notes

- Data in this report were collected by the Bureau of the Census for the National Science Foundation (NSF) in the Annual Survey of Industrial Research and Development and cover the periods 1956-83 for funding data and January 1957-January 1984 for personnel data.

- The footnote "Not separately available but included in total" indicates that data are being withheld either (1) to avoid disclosing the operations of an individual company; or, (2) because the imputation rate--the percentage of that statistic estimated by the Bureau of the Census (Census)--exceeds 50 percent as a result of the failure of some companies to supply the requested data. See table A-1 for the imputation rates of specific items.

- The industry survey does not cover trade associations. Although their primary mission is to serve industry, trade associations are established as nonprofit organizations and are covered in the NSF survey of independent nonprofit institutions. R&D expenditures of trade associations are estimated at less than 1 percent of the industry R&D total.

- Complete technical notes are contained in section A. Questions regarding these survey findings should be addressed to Melissa Pollak or Mary Burke, Industry Studies Group, Division of Science Resources Studies, National Science Foundation, Washington, D. C. 20550 (202) 634-4648.

III

Section A

Technical Notes

Scope of Study

The National Science Foundation (NSF) sponsored its first survey of industrial research and development in 1953. Since then, the scope of the survey has gradually been expanded and refined in response to an increasing need for more detailed information on the Nation's research and development (R&D) effort.

The 1983 industry survey is the 27th in the annual series sponsored by NSF and conducted by the Bureau of the Census (Census), Department of Commerce. NSF also sponsored two industry surveys covering the 1953-56 period, which were conducted by the Bureau of Labor Statistics (BLS), Department of Labor. 1/ Data obtained in the BLS survey are not directly comparable with the Census figures for 1957-83 because of methodological and other differences in the surveys conducted by the two agencies. In addition, beginning in 1957, the Census surveys have collected data on the R&D activities of federally-funded research and development centers (FFRDC's) operated by business firms, whereas the earlier BLS surveys did not. FFRDC's are organizations administered by industrial, educational, or other institutions on a nonprofit basis; they conduct R&D activities almost exclusively for the use of the Federal Government. R&D expenditures of industry-administered FFRDC's are included in the Federal R&D data under the classifications of the administering firms. Total R&D expenditures and selected personnel data for FFRDC's are shown in table B-15. To account for the performance of these research centers in 1956, Census adjusted data for that year (collected in the 1957 survey) to provide comparable trend data for 1956 and earlier years.

Data on scientific personnel are not directly comparable with data in surveys formerly conducted by BLS. Census uses the company--defined to include all establishments under common ownership or control--as the basic reporting unit for these surveys of industrial research and development. The surveys of scientific and technical personnel conducted by BLS were on an establishment-reporting-unit basis. Further, the Census surveys obtain data on the number of R&D scientists and engineers on a full-time-equivalent (FTE) basis, unlike the BLS surveys in which data were provided in terms of scientists and engineers primarily employed in research and development.

Other variations in the two sets of data may be the result of different offices in the same company preparing the estimates, or the varying response rates of the two surveys.

The statistics presented in this report are subject to response and concept errors caused by differences between survey and industry concepts and definitions of R&D activities, and by variations in company accounting procedures. Consequently, the accuracy of the data provided by respondents is subject to some variation.

Data quality has improved substantially since the first industry survey in 1953, mainly as a result of more accurate and sophisticated accounting procedures adopted by respondents. In addition, NSF and Census have endeavored to reduce response and concept errors arising from difficulties in interpreting or applying survey definitions.

NSF has been aware of the increased reporting burden placed on industry from all sources in recent years. In an effort to alleviate this burden, the detailed questionnaire (which has been in use with slight modifications since the beginning of the survey) is now mailed only biennially; an abbreviated form containing only the most crucial data elements is sent to survey respondents in the intervening years.

The shortened survey form was used for the first time to collect industrial R&D data for 1978. Because all data elements were not collected for 1978, 1980, and 1982, some historical tables do not contain data for these years and other tables were not printed in the 1978, 1980, and 1982 publications. The main tables affected are those which give detailed breakdowns of R&D expenditures for basic research, applied research, and development by industry and by product field. Other tables showing company-financed research and development contracted to outside organizations, Federal funds by agency, R&D expenditures by geographic area, and some detailed data on energy and pollution abatement R&D activities are also deleted in those years.

Survey Definitions 2/

Research and development--Basic and applied research in the sciences and engineering and the design and development of prototypes and processes. This definition excludes quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, and other nontechnological activities or technical services.

Basic research--Original investigations for the advancement of scientific knowledge not having specific commercial objectives, although such investigations may be in fields of present or potential interest to the reporting company.

Applied research--Investigations directed to the discovery of new scientific knowledge having specific commercial objectives with respect to products or processes. This definition differs from that of basic research chiefly in terms of the objectives of the reporting company.

Development--Technical activities of a nonroutine nature concerned with translating research findings or other scientific knowledge into products or processes. Not included are routine technical services to customers or other activities excluded from the above definition of research and development.

Funds for research and development--Operating expenses incurred by a company in the conduct of research and development in its own laboratories or other company-owned or -operated facilities. Includes wages and salaries, materials and supplies consumed, property and other taxes, maintenance and repairs, depreciation, and an appropriate share of overhead, but excludes capital expenditures. All funds for R&D performance are expressed in current rather than constant dollars.

Federally-financed research and development--Receipts for work done by the company on Federal R&D contracts or subcontracts and R&D portions of procurement contracts and subcontracts.

Company-financed research and development--Cost of the company-sponsored research and development performed within the company. Does not include company-financed research and development contracted to outside organizations, such as research institutions, universities and colleges, or other nonprofit organizations.

R&D scientists and engineers--The January number of those engaged full time in research and development and the full-time equivalent of those working part time in research and development. Scientists and engineers are defined as persons engaged in scientific or engineering work at a level which requires a knowledge of physical, life, engineering, or mathematical sciences equivalent at least to that acquired through completion of a 4-year college program with a major in one of those fields.

Employment--Total number of persons domestically employed by the company in all activities during the pay period that includes the 12th of March. These data are not completely comparable with employment of R&D scientists and engineers data which are collected as of January.

Net sales and receipts--Recorded dollar values for goods sold or services rendered by a company to customers outside the company, including the Federal Government, less such items as returns, allowances, freight, charges, and excise taxes. Excludes domestic intracompany transfers as well as sales by foreign subsidiaries, but includes transfers to foreign subsidiaries and export sales to foreign companies. For companies classified in the communication equipment industry (SIC 366), manufacturing sales are included and revenues from their telecommunication activities are excluded. Net sales and receipts figures are expressed in current rather than constant dollars. All tables which include net sales figures, with the exception of table B-20, do not include data for nonmanufacturing companies.

Geographic area covered--Includes only those operations located in the 50 States and the District of Columbia. 3/

Explanation of Tabular Data

Industry classification--Industries and industry groups shown separately in statistical tables are classified according to their Standard Industrial Classification (SIC) Manual 4/ codes as follows:

- Food and kindred products (20)
- Textiles and apparel (22, 23)
- Lumber, wood products, and furniture (24, 25)
- Paper and allied products (26)
- Chemicals and allied products (28)
  - Industrial chemicals (281-82, 286) 5/
  - Drugs and medicines (283)
  - Other chemicals (284-85, 287-89) 5/
- Petroleum refining and related industries (29) 6/
- Rubber products (30)
- Stone, clay, and glass products (32)
- Primary metals (33)
  - Ferrous metals and products (331-32, 3398-99)
  - Nonferrous metals and products (333-36)
- Fabricated metal products (34)
- Machinery (35)
  - Office, computing, and accounting machines (357)
  - Other machinery, except electrical (351-56, 358-59)
- Electrical equipment (36) 6/
  - Radio and TV receiving equipment (365)
  - Communication equipment (366) 6/
  - Electronic components (367)
  - Other electrical equipment (361-64, 369)

Motor vehicles and motor vehicles equipment (371)
Other transportation equipment (373-75, 379)
Aircraft and missiles (372, 376) 7/
Professional and scientific instruments (38)
  Scientific and mechanical measuring instruments (381-82)
Optical, surgical, photographic, and other instruments (383-87)
Other manufacturing industries--tobacco manufacturers (21), printing and publishing (27), leather products (31), and miscellaneous manufacturing industries (39)
Nonmanufacturing industries--agriculture, forestry, and fisheries (07-09); mining and extraction (10-14); contract construction (15-17); transportation, communications, and other public utilities (41-49); wholesale and retail trade (50-59); finance, insurance, and real estate (60-67); and selected service industries (739, 807, 891).

Company size-class--The size of a company as determined by the total number of its employees. The following are the five company size-classes used in this report: fewer than 1,000 employees; 1,000 to 4,999 employees; 5,000 to 9,999 employees; 10,000 to 24,999 employees; and 25,000 or more employees.

Classification of reporting units--The company or corporate family which includes all establishments under common ownership or control is the basic reporting unit. Each company was similarly classified into a single size-category on the basis of its total employment.

Cost per R&D scientist or engineer--The number of R&D scientists and engineers used to estimate the cost per R&D scientist or engineer for 1957-83 is the arithmetic mean of the numbers of R&D scientists and engineers reported in each industry for January in two consecutive years. This number is then divided into total R&D expenditures in each industry. For example, the mean of the numbers of R&D scientists and engineers in January 1983 and January 1984 is divided into total 1983 R&D expenditures for a total cost per R&D scientist or engineer in 1983.

Nonavailability of certain statistics--Tables in section B use footnotes stating "Not separately available but included in total" indicating that statistics are withheld because they do not meet publication standards for the following reasons: (1) Extremely high associated sampling error of estimate; (2) high rate of imputation (over 50 percent) because of failure of companies to supply data; (3) possible disclosure of data on an individual company; or, (4) data inconsistent for inclusion in a time series. In some instances, withheld data can be derived by subtraction from higher level totals. Where this is possible, the data user should be aware that the derived numbers are statistically unreliable. In no instance, however, can any data be derived that would disclose the operations of an individual company.

Questionable data--Data where over 50 percent of the total has been estimated are not published. Users should consult table A-1 for imputation rates for specific items.

Method of computation--Detailed statistics in the tables may not add to totals or subtotals because of rounding. Also, percentages were calculated on the basis of thousands of dollars and may differ from those based on the rounded figures shown.

Methodology of Survey 8/

The sample used for the 1983 Survey of Industrial Research and Development represents all manufacturing industries and those nonmanufacturing industries known, on the basis of earlier, more detailed samples, to conduct or to finance research and development. The sampling unit for the survey was the company, defined as a business organization consisting of one or more establishments under common ownership or control. A new panel for the R&D survey is selected approximately every five years. The newest sample was selected for the 1981 survey (the first since the 1976 survey). Approximately 11,500 manufacturing and nonmanufacturing companies are included in this sample, which consists of about 4,500 certainty companies (those with 500 or more employees that have a 100-percent chance of inclusion in the panel) and about 7,000 noncertainty companies.

The basic tool for the survey is Form RD-1, which is used to collect detailed R&D information. Companies in the new panel that received an RD-1 form in the old panel once again received an RD-1 form in 1981 (about 1,200 companies). The remaining certainty (about 3,300) companies and noncertainty companies (about 7,000) in the new panel received an RD-1A survey form for 1981. Form RD-1A is an abbreviated version of RD-1 and is generally mailed only to companies in the year in which a new sample is drawn. The purpose of Form RD-1A is to canvass, with a minimum of reporting burden, smaller R&D performers. Once the RD-1A forms were received and tabulated from the survey respondents in 1981, they were reviewed for total R&D expenditures. Those companies which reported R&D expenditures exceeding $1,000,000 on the RD-1A form were added to the survey panel consisting of those firms that receive the RD-1 form annually--about 575 such companies in 1981. Data for remaining RD-1A companies in subsequent years are estimated by Census based upon their 1981 reports.

The universe frame from which the latest sample panel was selected was created from two sources--the 1981 Standard Statistical Establishment List (SSEL) for single units and the 1981 Enterprise Statistics Multiunits file.

There are about 3.5 to 4 million single-unit firms in the 1981 SSEL file (including nonmanufacturing firms). There are 5.6 million multiunit companies in the 1981 Enterprise file, of which 296,146 companies have identified themselves as being primarily in manufacturing. All manufacturing industries and selected nonmanufacturing industries (SIC's 49, 7391, 7392, 7399, and 8911) were considered within the scope of the survey.

Companies in these industries with 500 or more employees were included in the panel with certainty. For the companies with fewer than 500 employees, a measure of size was assigned to each company based on an estimate of its total R&D expenditures. Probabilities of selection were then assigned based on the measure of size. Finally, a sample selection process gave each company an independent chance of being included in the sample.

Each year Census reviews the annual lists of R&D contractors published by the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA) to ensure that the large contractors are included in the sample. For the 1983 survey, the R&D-performing manufacturing companies from the largest DOD and NASA contractors were included in the reporting panel with certainty.

The particular sample selected is one of a large number of samples of the same type and size that, by chance, might have been selected. Estimates from each of the different samples would differ somewhat from each other and from the results of a complete canvass conducted under essentially the same conditions as the survey. This variation among the possible estimates is defined by the sampling error, measured in standard error units. The complete canvass total would be included in the range--(1) from one standard error below to one standard error above the derived estimate for about two-thirds of all possible samples; (2) from two standard errors below to two standard errors above the derived estimate for about 95 percent of all possible samples; and (3) from three standard errors below to three standard errors above the derived estimate, almost always.

An inference that the comparable complete canvass total would be within the indicated ranges would be correct in approximately the relative frequencies shown. Those proportions, therefore, may be interpreted as defining the confidence that the estimates from a particular sample would differ from complete coverage results by as much as one, two, or three standard errors, respectively.

For example, suppose an estimated total is shown as 400 with an associated relative standard error of 2 percent. Then, there is approximately 67-percent confidence that the interval 392 to 408 includes the complete canvass total, about 95-percent confidence that the interval 384 to 416 includes the complete canvas total, and almost certain confidence that the interval 376 to 424 includes the complete canvass total.

In addition to the sampling errors as measured by the standard error, the estimates are subject to errors in response, coding, processing, and imputation for nonresponse. These nonsampling errors would also occur if a complete canvass were to be conducted under the same conditions as the survey (table A-2).

The forms for the survey were mailed in January 1984, and nonrespondents received followup letters by mail. Since total R&D performance funds, total Federal R&D funds, total net sales, and total employment are included in the Census's mandatory statistical program, the few companies that did not reply to Form RD-1 for 1983 were mailed the Census Form MA-121, which collects these mandatory items.

In the absence of respondent-distributed data, Census has estimated data for items as required in accordance with past performance and industry averages. Table A-1 shows imputation rates for many survey items.

Comparability of Data over a Period of Several Years

In the survey of industrial research and development, there is substantial comparability over any 2-year period. Before mailing the survey forms each year, Census enters on each one the previous year's figures as reported by the respondent. The respondent is asked to adjust data for the previous year as necessary to make them comparable to those data being reported for the current year. Such adjustments are made to reflect, for example, changes in reporting concepts or changes in company structure such as mergers or acquisitions. To maintain some measure of consistency, the employment-size classification of any company affected by such changes has been adjusted so that the company is tabulated in the same employment-size category for two consecutive years.

Some measure of the degree of change reflecting these adjustments in contrast to an actual change in R&D activity can be gained by comparing figures for the same year reported for two succeeding reporting periods, e.g., R&D statistics in the final report of the 1982 survey and the revised 1982 R&D statistics in the final report of the 1983 survey. The totals for broad classifications are likely to be very close in the two reports; larger differences are noticeable in the finer detail. The results underscore the point that the measures are approximate and indicative rather than precise.

Industry Codes for 1967-83 9/

The industry codes appearing in the tables are based on the 1972 SIC Manual. The SIC code for individual companies for 1967-74 (which were utilized in the publications for those years) were originally determined by data reported in the 1967 Economic Censuses. The SIC classifications for individual companies for 1977-79 (which were utilized in the publications for those years) were originally determined by the 1974 SSEL file. Between 1967 and 1974 and again between 1977 and 1979, the SIC code for a company on the R&D survey generally remained fixed and reflected that company's principal activity as of 1967 or 1976. Under certain circumstances, however, such as the merger of two or more companies, the acquisition of one company by another, or the formation of conglomerates, the 1967 or 1976 SIC code for a company could have changed. Census could not be aware of a possible new SIC code for a company until the 1976 or 1981 new sample was drawn based upon the 1974 or 1981 SSEL file. (See the foregoing description of the new sample.) When the new sample was selected in each of the years 1976 and 1981, the industry codes of companies in both the old and new panels were examined for possible changes. The historical R&D tables (for example, 1968-74 and 1977-79) have been adjusted to reflect the change in company activities. Because it is not known normally when a company changed its industrial activities, the data were adjusted in the following fashion: For companies changing industry codes between 1967 and 1974, the industry total for each of the years affected (1968 through 1974) were estimated to have changed at a constant rate of 14.3 percent per year. Accordingly, the data for the industry in which such a company had been classified in 1967 were deflated by 14.3 percent per year for each of the years 1968-74 (for example, 14.3 percent subtracted in 1968, 28.6 percent in 1977, 42.9 percent in 1970, etc.). Similarly, data for the industry in which such a company was classified in 1974 were inflated by 14.3 percent per year for each of the years 1968-74. The industry code assigned to a company for 1981 was also used to classify that company's activities for 1982 and 1983.

Footnotes

1/ National Science Foundation, Science and Engineering in American Industry. Final Report on a 1953-54 Survey (NSF 56-16) and Science and Engineering in American Industry, 1956 (NSF 59-50) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1956 and 1960).

2/ For more detailed information on definitions, as well as the instructions for individual items covered in the survey questionnaire, see section c.

3/ For purposes of comparison, company-sponsored research and development by foreign subsidiaries of U.S. domestic companies performed outside the United States is reported in table B-9 but excluded from all other tables.

4/ Executive Office of the President, Office of Management and Budget, Standard Industrial Classification Manual, 1972 (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office). Industry group code numbers are shown in parentheses.

5/ The classification "Industrial Chemicals" has been revised to include SIC Group 286, Industrial Organic Chemicals. All current and historical tables have been revised accordingly.

6/ Starting with the 1978 survey, oil and gas extraction (13) was no longer grouped with petroleum refining (29), and communication (48) was no longer grouped with electrical equipment (36). Instead, these SIC groups are included in the nonmanufacturing sector so that the delineation between manufacturing and nonmanufacturing industries is more consistent. This change has had almost no effect on the levels of the data.

7/ Companies primarily engaged in the manufacture of ordnance and accessories, including complete guided missiles, are grouped with companies primarily engaged in the manufacture of aircraft and parts because of close similarity of R&D activities carried out by major companies in the two industries.

8/ This section was prepared in the Industry Division of the Bureau of the Census, the collecting and compiling agent for the National Science Foundation in this survey.

9/ For a discussion of industry codes for 1966 and earlier years, see National Science Foundation, Research and Development in Industry, 1975. Funds, 1975; Scientists & Engineers, January 1976 (NSF 77-324), and Research and Development in Industry, 1970. Funds, 1970; Scientists & Engineers, January 1971 (NSF 72-309) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1978 and 1972).

Table A-1. Imputation rates for selected items on the research and development survey by industry: 1983

[Percent]

Industry	SIC code	Item 2		Item 4	Item 5 R&D Expenditures: Total R&D			Item 11		Item 12	Item 13
		Sales[1]	Employment[1]	Scientists/engineers[1]	Total[1]	Company[1]	Federal[1]	Energy R&D	Pollution abatement	Outside company	Foreign R&D
Total	. ...	5.5	7.7	31.5	4.6	3.5	7.2	34.5	59.8	1.3	14.7
Distribution by industry											
Food and kindred products	20	8.1	6.5	42.7	6.0	6.0	-	77.8	17.7	-	14.6
Textiles and apparel	22,23	8.7	8.1	10.9	4.9	4.9	-	2.4	50.3	-	91.2
Lumber, wood products, and furniture	24,25	13.2	27.3	60.6	3.3	3.3	-	30.6	-	-	-
Paper and allied products	26	1.4	1.9	15.4	1.6	1.6	-	13.4	8.9	-	1.7
Chemicals and allied products	28	2.0	2.5	34.9	.9	.9	.1	.8	1.2	-	11.9
Industrial chemicals	281-82,286	.2	.1	19.2	-	-	-	.6	.7	-	8.2
Drugs and medicines	283	.6	3.0	52.8	.1	.1	-	-	12.6	-	16.3
Other chemicals	284-85,287-89	7.4	6.9	23.3	6.5	6.4	13.8	14.2	1.7	-	2.3
Petroleum refining and related industries	29	.2	.3	42.2	.3	.2	1.5	32.9	18.3	-	47.8
Rubber products	30	2.1	4.7	69.3	5.2	7.0	-	8.6	29.7	1.8	96.2
Stone, clay, and glass products	32	7.1	6.3	20.2	.5	.6	-	17.3	10.7	.6	-
Primary metals	33	2.2	5.6	19.6	1.6	2.5	-	23.9	4.5	-	26.9
Ferrous metals and products	331-32,3398-99	2.6	4.6	13.3	1.5	2.8	-	25.6	9.4	-	61.0
Nonferrous metals and products	333-36	1.3	8.5	31.6	1.9	2.1	-	22.8	-	-	2.8
Fabricated metal products	34	2.4	4.4	40.2	2.0	1.6	5.2	1.2	1.1	-	5.6
Machinery	35	5.2	5.0	17.3	.9	1.2	-	39.3	12.3	-	1.3
Office, computing, and accounting machines	357	.8	1.0	13.1	.5	.6	-	63.8	-	-	-
Other machinery, except electrical	351-56,358-59	5.8	5.5	19.0	1.6	1.9	-	34.2	16.7	-	6.5
Electrical equipment	36	5.4	6.2	30.2	4.6	7.5	.9	2.4	2.4	-	6.5
Radio and TV receiving equipment	365	2.6	2.5	7.4	1.6	3.0	-	-	-	-	-
Communication equipment	366	.9	2.3	13.8	.7	2.0	.8	-	-	-	.5
Electronic components	367	19.7	19.7	63.5	20.3	23.0	7.3	32.3	84.1	-	50.4
Other electrical equipment	361-64,369	4.0	4.6	35.9	3.9	7.7	-	2.2	.6	-	6.5
Motor vehicles and motor vehicles equipment	371	1.7	1.9	3.7	.3	.4	-	95.5	94.1	-	.2
Other transportation equipment	373-75,379	10.5	12.5	50.5	29.6	24.8	36.9	3.2	100.0	-	-
Aircraft and missiles	372,376	2.3	10.7	22.8	10.8	6.5	12.2	46.5	22.1	-	9.0
Professional and scientific instruments	38	2.6	3.2	68.1	1.9	2.2	-	10.3	1.6	-	70.9
Scientific and mechanical measuring instruments	381-82	3.6	3.9	75.2	2.5	3.2	-	10.0	-	-	95.2
Optical, surgical, photographic, and other instruments	383-87	1.9	2.7	55.0	1.3	1.4	-	24.7	2.1	-	54.6
Other manufacturing industries	21,27,31,39	3.8	9.0	57.3	7.7	8.1	-	12.5	48.7	-	73.3
Nonmanufacturing industries	07-17,41-67, 737,739,807,891	.4	.9	33.8	5.0	5.5	4.2	31.0	2.8	-	33.4

Note: Imputation rates are not available for basic, applied, and development by source of funds or by field of science or by product group, and for research and development by type of cost because imputation was performed by a computer program that did not calculate the rates. Imputation rates for these data elements will be available for the 1985 survey year.

- Represents no imputation.

[1] These items calculated from Form RD-1 (detailed form mailed to large corporations conducting research and development) and from Form RD-1A (abbreviated version of RD-1 form mailed to smaller R&D performers). All other items calculated from Form RD-1 only; RD-1A respondents were not asked these questions.

Table A-2. Standard error of estimate (percentage) of funds for R&D performance for all company size-groups and for companies with less than 1,000 employees by industry: 1983

Industry	SIC code	Standard error[1]	Standard error of companies with less than 1,000 employees
Total	....	1	10
Food and kindred products	20	1	15
Textiles and apparel	22,23	4	21
Lumber, wood products, and furniture	24,25	2	25
Paper and allied products	26	1	36
Chemicals and allied products	28	1	8
Industrial chemicals	281-82,286	([2])	11
Drugs and medicines	283	3	20
Other chemicals	284-85,287-89	2	14
Petroleum refining and related industries	29	([2])	5
Rubber products	30	3	33
Stone, clay, and glass products	32	2	32
Primary metals	33	2	24
Ferrous metals and products	331-32,3398-99	1	21
Nonferrous metals and products	333-36	7	35
Fabricated metal products	34	2	17
Machinery	35	1	9
Office, computing, and accounting machines	357	1	14
Other machinery, except electrical	351-56,358-59	2	12
Electrical equipment	36	([2])	10
Radio and TV receiving equipment	365	2	32
Communication equipment	366	([2])	15
Electronic components	367	2	24
Other electrical equipment	361-64,369	([2])	12
Motor vehicles and motor vehicles equipment	371	([2])	26
Other transportation equipment	373-75,379	1	20
Aircraft and missiles	372,376	2	94
Professional and scientific instruments	38	1	14
Scientific and mechanical measuring instruments	381-82	2	23
Optical, surgical, photographic, and other instruments	383-87	1	12
Other manufacturing industries	21,27,31,39	2	12
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	8	30

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[1] A description of the standard error of estimate is given in section A under "Methodology of Survey." The percentage (or relative) standard errors in this table may be converted to standard errors of estimate by multiplying the percentage shown by the associated estimate. For example, the relative standard error of estimate for R&D performance for all company size groups in the machinery industry (SIC 35) is shown as 1 percent, and the associated total R&D estimate for this industry is shown as $8,382 million in table B-2, "Funds for research and development by industry and size of company: 1983." The standard error of estimate, then, is .01 times 8,382 or 83.82.

[2] Less than 0.5 percent.

Section B

Statistical Tables

In all tables of this report

- Details may not add to totals because of rounding.
- Percentages were calculated on the basis of thousands of dollars and may differ from those based on the rounded figures shown.
- Percentage changes are increases unless otherwise indicated.

Page

Total Funds for Research and Development

B-1. Trends in funds for industrial research and development by source: 1956-83 18
B-2. Funds for research and development by industry and size of company: 1956, 1958, 1963, 1967, and 1972-83............................ 19
B-3. Funds for research and development by industry and size of company: 1983..................... 20
B-4. Funds for research and development by industry, size of company, and size of R&D program: 1983.................................... 21

Company Funds for Research and Development

B-5. Company funds for research and development by industry and size of company: 1957-58, 1963, 1967, and 1972-83............................ 22
B-6. Company funds for research and development by industry and size of company: 1983 23
B-7. Company-financed research and development contracted to outside organizations by industry and size of company: 1983 24

Page

B-8. Companies with 1,000 or more employees contracting research and development to outside organizations by industry and size of company: 1983.................... 25
B-9. Company-financed research and development performed by foreign subsidiaries of U.S. domestic companies outside the United States by selected industry: 1974-83 26
B-10. Company funds for R&D performance by selected industry: 1983 actual and 1984 projected 26

Federal Funds for Research and Development

B-11. Federal funds for research and development by industry and size of company: 1957-58, 1963, 1967, and 1972-83.. 27
B-12. Federal funds for research and development by industry and size of company: 1983................................ 28
B-13. Federal funds for research and development by selected industry and agency: 1963-77, 1979, 1981, and 1983..... 29
B-14. R&D-performing companies with 1,000 or more employees and number with Federal R&D funds by industry and size of company: 1983....................................... 30
B-15. Industry-administered federally-funded research and development centers--composition of work force and funds by character of work: 1982-83.......................... 31

R&D Funds by Size of Company

B-16. R&D-performing companies in manufacturing and non-manufacturing industries by size of company: 1983...... 31
B-17. R&D-performing companies with 1,000 or more employees by size of company and R&D program: 1983................. 31
B-18. R&D-performing manufacturing companies with 5,000 or more employees by industry and percent change in R&D funds: 1982-83.. 32
B-19. Percent of total, Federal, and company funds of R&D-performing companies ranked by size of R&D program: 1972-83.. 33

R&D Funds Related to Net Sales

B-20. Net sales of R&D-performing companies by industry and size of company: 1982-83.............................. 34
B-21. R&D funds as a percent of net sales in R&D-performing manufacturing companies by industry and size of company: 1957-58, 1963, 1967, and 1972-83............................ 35

Page
B-22. Company R&D funds as a percent of net sales in R&D-performing manufacturing companies by industry and size of company: 1957-58, 1963, 1967, and 1972-83............................ 36
B-23. R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of R&D program by industry: 1983.......... 37
B-24. Company R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of net sales by industry: 1983......... 38
B-25. Percent of net sales and employment of R&D-performing companies ranked by size of R&D program: 1972-83.............................. 38
B-26. Percent of total and Federal R&D funds and of net sales of R&D-performing companies ranked by size of R&D program by industry: 1983.......... 39

Funds for Research and Funds for Development

B-27. Funds for basic research, applied research, and development performance: 1953-83............... 40
B-28. Funds for basic research, applied research, and development by industry and size of company: 1983.. 41
B-29. Funds for basic research, applied research, and development by industry, source of funds, and selected company size-groups: 1983............. 42
B-30. Funds for basic research by industry and size of company: 1957-58, 1963, 1967, 1972-77, 1979, 1981, and 1983................................ 43
B-31. Funds for basic research by field of science and engineering: 1967, 1972-77, 1979, 1981, and 1983 44
B-32. Funds for basic research by industry and field of science and engineering: 1983............... 44
B-33. R&D-performing companies with 1,000 or more employees conducting basic research by industry: 1983.. 45

Funds for Applied Research and Development by Product Field

B-34. Funds for applied research and development by product field: 1963-64, 1967-77, 1979, 1981, and 1983.................................... 46
B-35. Funds for applied research and development by product field and source of funds: 1983........ 47
B-36. Funds for applied research and development by industry and product field: 1983............... 48
B-37. Funds for applied research and development by industry and secondary product field: 1983..... 50

Energy and Pollution Abatement Research and Development

B-38. Expenditures for energy research and development by selected industry: 1972-84 (projected)...... 52
B-39. Company funds for energy research and development by selected industry: 1973-83................. 52

Page
B-40. Federal funds for energy research and development by selected industry: 1973-83.................... 53
B-41. Industrial expenditures for energy research and development by primary energy source: 1972-84 (projected) 53
B-42. Company funds for energy research and development by primary energy source: 1972-83................ 54
B-43. Federal funds for energy research and development by primary energy source: 1972-83................ 54
B-44. Expenditures for pollution abatement research and development by industry: 1973-84 (projected)..... 55
B-45. Company funds for pollution abatement research and development by selected industry: 1973-83.... 56
B-46. Federal funds for pollution abatement research and development by selected industry: 1973-83.... 56
B-47. Industrial expenditures for pollution abatement research and development by type of pollution: 1973-84 (projected)............................ 56
B-48. Industrial expenditures for pollution abatement research and development by type of pollution and source of funds: 1982-83........................ 57

Research and Development Distribution by Special Categories

B-49. Company R&D expenditures to meet regulations by agency by selected industry: 1983................ 57

Geographic Distribution of R&D Funds

B-50. Geographic distibution of funds for industrial research and development: 1963, 1966-77, 1979, 1981, and 1983.................................. 58
B-51. Geographic distribution of funds for industrial research and development by source of funds: 1983.. 59

Distribution of R&D Funds by Major Type of Cost

B-52. Distribution of R&D costs by industry and type of cost: 1983.................................... 60

Employment

B-53. Full-time-equivalent number of R&D scientists and engineers by industry and size of company: 1957-58, 1963-64, 1967-68, and 1973-84..................... 61
B-54. Full-time-equivalent number of R&D scientists and engineers by industry and source of R&D funds: January 1984.................................. 62
B-55. Cost per R&D scientist or engineer by industry and size of company: 1957-58, 1963, 1967, and 1972-83 63
B-56. Cost per R&D scientist or engineer by industry and size of company: 1983......................... 64
B-57. Cost per R&D scientist or engineer in companies ranked by size of R&D program: 1972-83........... 65

Page

B-58. Total employment of R&D-performing companies by industry and size of company: 1982-83............ 66
B-59. R&D scientists and engineers per 1,000 employees by industry and size of company: 1958, 1963, 1967, and 1972-83...................................... 67
B-60. Total and company R&D funds per employee by size of company: 1963, 1967, and 1972-83.............. 68

Table B-1. Trends in funds for industrial research and development by source: 1956-83

[Dollars in millions]

Year	Total R&D		Federal		Company[1]	
	Amount	Percent change from previous year	Amount	Percent of total	Amount	Percent of total
1956	$6,605	42	$3,328	50	$3,277	50
1957	7,731	17	4,335	56	3,396	44
1958	8,389	9	4,759	57	3,630	43
1959	9,618	15	5,635	59	3,983	41
1960	10,509	9	6,081	58	4,428	42
1961[2]	10,908	4	6,240	57	4,668	43
1962	11,464	5	6,434	56	5,029	44
1963	12,630	10	7,270	58	5,360	42
1964	13,512	7	7,720	57	5,792	43
1965	14,185	5	7,740	55	6,445	45
1966	15,548	10	8,332	54	7,216	46
1967	16,385	5	8,365	51	8,020	49
1968	17,429	6	8,560	49	8,869	51
1969	18,308	5	8,451	46	9,857	54
1970	18,067	-1	7,779	43	10,288	57
1971	18,320	1	7,666	42	10,654	58
1972	19,552	7	8,017	41	11,535	59
1973	21,249	9	8,145	38	13,104	62
1974	22,887	8	8,220	36	14,667	64
1975	24,187	6	8,605	36	15,582	64
1976	26,997	12	9,561	35	17,436	65
1977	29,825	10	10,485	35	19,340	65
1978	33,304	12	11,189	34	22,115	66
1979	38,226	15	12,518	33	25,708	67
1980	44,505	16	14,029	32	30,476	68
1981	51,810	16	16,382	32	35,428	68
1982	57,996	12	18,483	32	39,512	68
1983	62,816	8	20,215	32	42,600	68

[1] Company funds include all funds for industrial R&D work performed within company facilities except funds provided by the Federal Government. Excluded are company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other nonprofit organizations.

[2] Funds by source estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table B-2. Funds for research and development by industry and size of company: 1956, 1958, 1963, 1967, and 1972-83

[Dollars in millions]

Industry and size of company	SIC code	1956	1958	1963	1967	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	....	$6,605	$8,389	$12,630	$16,385	$19,552	$21,249	$22,887	$24,187	$26,997	$29,825	$33,304	$38,226	$44,505	$51,810	$57,996	$62,816
Distribution by industry																	
Food and kindred products	20	64	83	130	183	259	269	298	335	355	415	472	528	620	(1)	(1)	(1)
Textiles and apparel	22,23	(1)	26	30	57	61	64	69	70	82	83	89	101	115	(1)	(1)	(1)
Lumber, wood products, and furniture	24,25	(1)	12	11	12	64	71	84	88	107	123	126	139	148	161	162	171
Paper and allied products	26	36	42	69	128	189	194	237	249	313	333	387	445	495	(1)	626	(1)
Chemicals and allied products	28	641	792	1,239	1,507	1,932	2,116	2,450	2,727	3,017	3,202	3,580	4,038	4,636	5,625	6,659	7,287
Industrial chemicals	281-82,286	460	553	809	966	1,031	1,119	1,299	1,391	1,524	1,668	1,798	1,962	2,197	2,802	3,301	3,409
Drugs and medicines	283	94	128	216	343	607	698	807	981	1,091	1,117	1,308	1,517	1,777	(1)	(1)	(1)
Other chemicals	284-85,287-89	87	111	214	198	294	299	344	354	401	417	474	559	662	(1)	(1)	(1)
Petroleum refining and related industries	29	182	246	317	371	468	598	622	693	767	918	1,060	1,262	1,552	(1)	(1)	(1)
Rubber products	30	(1)	89	156	182	377	426	469	467	502	491	493	577	656	(1)	(1)	(1)
Stone, clay, and glass products	32	[2]60	[2]75	100	136	183	199	217	233	263	287	324	356	406	(1)	(1)	(1)
Primary metals	33	90	131	183	242	277	307	358	443	506	538	560	634	728	878	1,000	1,096
Ferrous metals and products[3]	331-32,3398-99	(1)	80	106	135	146	163	181	215	256	284	314	375	443	(1)	(1)	(1)
Nonferrous metals and products[3]	333-36	(1)	51	77	167	130	145	177	228	250	254	246	259	285	(1)	(1)	(1)
Fabricated metal products	34	116	162	153	163	253	291	313	324	358	386	384	455	550	624	568	634
Machinery	35	543	781	958	1,326	2,158	2,549	2,985	3,196	3,487	3,880	4,283	4,825	5,901	6,818	7,835	8,382
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	1,456	1,733	2,103	2,220	2,402	2,655	2,883	3,214	3,962	(1)	(1)	(1)
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	1,225	1,400	1,611	1,939	(1)	(1)	(1)
Electrical equipment	36	1,516	1,969	2,868	3,867	4,680	4,902	5,011	5,105	5,636	5,886	6,507	7,824	9,175	10,329	11,642	13,651
Radio and TV receiving equipment	365	(6)	(6)	(6)	45	48	49	51	50	52	96	130	245	556	(1)	(1)	(1)
Communication equipment	366	(1)	868	1,773	2,425	2,583	2,613	2,424	2,385	2,511	2,725	2,999	3,635	4,024	4,758	5,750	6,724
Electronic components	367					330	406	489	549	691	770	902	1,169	1,547	1,573	1,661	2,016
Other electrical equipment	361-64,369	(1)	1,101	1,093	1,397	1,719	1,834	2,047	2,121	2,382	2,295	2,476	2,775	3,048	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	688	856	1,090	1,354	1,954	2,405	2,389	2,340	2,778	3,358	3,879	4,509	4,955	4,806	4,807	5,372
Other transportation equipment	373-75,379					56	72	87	90	94	120	131	159	162	(1)	(1)	(1)
Aircraft and missiles	372,376	2,138	2,609	4,712	5,669	4,950	5,052	5,278	5,713	6,339	7,033	7,536	8,041	9,198	11,968	13,658	13,741
Professional and scientific instruments	38	200	294	284	542	838	961	1,075	1,173	1,331	1,571	1,998	2,505	3,029	3,614	4,019	4,387
Scientific and mechanical measuring instruments	381-82	97	156	70	104	163	186	221	266	325	452	670	950	1,352	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	103	138	214	438	675	775	854	907	1,007	1,119	1,328	1,555	1,677	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	(1)	105	54	90	146	158	177	205	217	243	266	288	364	(1)	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	117	276	559	707	715	768	735	845	958	1,229	1,540	1,815	1,906	2,005	2,065
Distribution by size of company (based on number of employees)																	
Less than 1,000	....	369	532	619	687	929	940	1,058	1,222	1,384	1,353	1,438	1,764	2,065	2,305	2,501	2,899
1,000 to 4,999	....	[2]550	642	1,022	1,017	1,215	1,248	1,370	1,385	1,500	1,526	1,931	2,483	2,701	3,148	3,599	4,022
5,000 to 9,999	....	[2]5,686	7,215	10,989	892	1,076	1,168	1,346	1,478	1,648	1,829	1,551	1,691	2,028	2,988	2,756	2,944
10,000 to 24,999	....				13,790	2,159	2,236	2,416	2,633	2,874	3,418	4,278	5,191	6,017	6,762	7,816	8,585
25,000 or more	....					14,173	15,657	16,697	17,469	19,591	21,699	24,106	27,097	31,693	36,607	41,322	44,366

[1] Not separately available but included in total. See general notes.
[2] Estimated by the National Science Foundation.
[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1956-63.
[4] Data not tabulated at this level prior to 1972.
[5] Data not tabulated at this level prior to 1977.
[6] Included in the other electrical equipment group.

SOURCE: National Science Foundation.

Table B-3. Funds for research and development by industry and size of company: 1983

[Dollars in millions]

Industry	SIC code	Total	Companies with total employment of--				
			Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	$62,816	$2,899	$4,022	$2,944	$8,585	$44,366
Food and kindred products	20	(1)	26	75	130	(1)	346
Textiles and apparel	22,23	(1)	24	18	22	47	(1)
Lumber, wood products, and furniture	24,25	171	13	43	26	(1)	(1)
Paper and allied products	26	(1)	(1)	56	30	(1)	376
Chemicals and allied products	28	7,287	243	(1)	(1)	2,617	3,151
Industrial chemicals	281-82,286	3,409	76	(1)	(1)	408	2,500
Drugs and medicines	283	(1)	(1)	(1)	175	(1)	(1)
Other chemicals	284-85,287-89	(1)	(1)	226	106	(1)	(1)
Petroleum refining and related industries	29	(1)	(1)	(1)	(1)	(1)	(1)
Rubber products	30	(1)	99	(1)	(1)	(1)	384
Stone, clay, and glass products	32	(1)	35	(1)	44	(1)	118
Primary metals	33	1,096	(1)	145	(1)	172	(1)
Ferrous metals and products	331-32,3398-99	(1)	20	(1)	(1)	(1)	561
Nonferrous metals and products	333-36	(1)	(1)	(1)	36	(1)	(1)
Fabricated metal products	34	634	88	147	(1)	(1)	(1)
Machinery	35	8,382	570	707	(1)	(1)	5,817
Office, computing, and accounting machines	357	(1)	(1)	326	171	(1)	(1)
Other machinery, except electrical	351-56,358-59	(1)	(1)	381	(1)	(1)	(1)
Electrical equipment	36	13,651	480	650	461	1,706	10,354
Radio and TV receiving equipment	365	(1)	(1)	25	(1)	(1)	(1)
Communication equipment	366	6,724	(1)	250	(1)	850	5,286
Electronic components	367	2,016	(1)	(1)	177	(1)	(1)
Other electrical equipment	361-64,369	(1)	(1)	(1)	(1)	391	3,430
Motor vehicles and motor vehicles equipment	371	5,372	14	(1)	(1)	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	18	28	(1)	115
Aircraft and missiles	372,376	13,741	(1)	153	(1)	707	12,558
Professional and scientific instruments	38	4,387	(1)	350	(1)	(1)	2,852
Scientific and mechanical measuring instruments	381-82	(1)	(1)	250	(1)	249	1,238
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	100	(1)	(1)	1,614
Other manufacturing industries	21,27,31,39	(1)	46	152	74	(1)	171
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	2,065	546	584	(1)	(1)	(1)

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-4. Funds for research and development by industry, size of company, and size of R&D program: 1983

Industry and size of company	SIC code	Total	R&D size of program [thousands of dollars]				
			Less than $200	$200 to $999	$1,000 to $9,999	$10,000 to $99,999	$100,000 or more
			[Millions of dollars]				
Total	....	$62,816	$507	$793	$3,542	$11,321	$46,653
Food and kindred products	20	(1)	(1)	(1)	203	523	0
Textiles and apparel	22,23	(1)	(1)	23	71	30	0
Lumber, wood products, and furniture	24,25	171	10	15	56	90	0
Paper and allied products	26	(1)	3	18	(1)	251	(1)
Chemicals and allied products	28	7,287	47	65	288	1,820	5,066
Industrial chemicals	281-82,286	3,409	8	20	112	672	2,597
Drugs and medicines	283	(1)	(1)	20	(1)	783	(1)
Other chemicals	284-85,287-89	(1)	(1)	25	(1)	365	(1)
Petroleum refining and related industries	29	(1)	(1)	3	35	267	1,808
Rubber products	30	(1)	(1)	(1)	(1)	(1)	(1)
Stone, clay, and glass products	32	(1)	(1)	28	60	336	101
Primary metals	33	1,096	5	22	137	539	392
Ferrous metals and products	331-32,3398-99	(1)	(1)	19	72	295	392
Nonferrous metals and products	333-36	(1)	(1)	3	65	244	0
Fabricated metal products	34	634	30	48	143	413	0
Machinery	35	8,382	122	144	659	1,430	6,027
Office, computing, and accounting machines	357	(1)	(1)	30	229	589	5,264
Other machinery, except electrical	351-56,358-59	(1)	(1)	114	430	841	763
Electrical equipment	36	13,651	53	125	530	1,210	11,733
Radio and TV receiving equipment	365	(1)	(1)	13	(1)	(1)	(1)
Communication equipment	366	6,724	14	33	105	452	6,120
Electronic components	367	2,016	18	27	183	358	1,430
Other electrical equipment	361-64,369	(1)	(1)	53	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	5,372	2	9	36	367	4,958
Other transportation equipment	373-75,379	(1)	(1)	(1)	34	(1)	(1)
Aircraft and missiles	372,376	13,741	1	7	272	348	13,113
Professional and scientific instruments	38	4,387	33	79	402	539	3,334
Scientific and mechanical measuring instruments	381-82	(1)	(1)	45	(1)	393	(1)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	34	(1)	145	(1)
Other manufacturing industries	21,27,31,39	(1)	(1)	28	124	367	0
Nonmanufacturing industries	{07-17,41-67,737, 739,807,891}	2,065	72	58	435	955	546
Distribution by size of company (based on number of employees)							
Less than 1,000	....	2,899	484	651	1,415	349	0
1,000 to 4,999	....	4,022	(1)	(1)	1,431	2,368	0
5,000 to 9,999	....	2,944	(1)	(1)	449	2,315	527
10,000 to 24,999	....	8,585	0	(1)	(1)	3,742	4,217
25,000 or more	....	44,366	0	(1)	(1)	2,547	39,909

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-5. Company funds for research and development by industry and size of company: 1957-58, 1963, 1967, and 1972-83

[Dollars in millions]

Industry and size of company	SIC code	1957	1958	1963	1967	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	....	$3,396	$3,630	$5,360	$8,020	$11,535	$13,104	$14,667	$15,582	$17,436	$19,340	$22,115	$25,708	$30,476	$35,428	$39,512	$42,600
Distribution by industry																	
Food and kindred products	20	74	77	(1)	181	258	268	297	(1)	(1)	(1)	(1)	(1)	(1)	636	762	799
Textiles and apparel	22,23	14	20	(1)	(1)	61	63	(1)	(1)	(1)	(1)	(1)	(1)	(1)	116	124	131
Lumber, wood products, and furniture	24,25	14	12	(1)	12	(1)	(1)	(1)	88	106	123	126	139	148	161	162	171
Paper and allied products	26	35	42	69	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	495	566	626	681
Chemicals and allied products	28	616	666	1,004	1,297	1,741	1,913	2,236	2,490	2,751	2,907	3,250	3,692	4,264	5,205	6,226	6,839
Industrial chemicals	281-82,286	423	443	662	785	860	936	1,105	1,173	1,275	1,387	1,473	1,617	1,856	2,393	2,879	2,969
Drugs and medicines	283	104	126	207	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1,756	2,064	2,490	2,931
Other chemicals	284-85,287-89	89	97	135	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	653	747	856	940
Petroleum refining and related industries	29	200	234	296	355	454	485	603	(1)	715	842	939	1,109	1,401	1,780	1,981	2,032
Rubber products	30	70	68	111	160	255	280	(1)	(1)	(1)	(1)	(1)	(1)	(1)	598	665	746
Stone, clay, and glass products	32	(1)	(1)	97	134	168	184	203	(1)	(1)	(1)	(1)	(1)	363	411	414	448
Primary metals	33	103	117	174	234	264	297	350	422	481	494	497	539	594	702	721	704
Ferrous metals and products[2]	331-32,3398-99	63	78	105	134	144	159	(1)	211	252	261	271	305	338	415	436	420
Nonferrous metals and products[2]	333-36	40	39	69	100	121	138	(1)	211	229	233	226	234	256	287	285	284
Fabricated metal products	34	97	105	129	151	243	279	299	297	322	342	348	414	501	545	510	568
Machinery	35	397	438	709	1,004	1,758	2,120	2,473	2,687	2,955	3,403	3,901	4,490	5,254	6,124	6,977	7,238
Office, computing, and accounting machines	357	(3)	(3)	(3)	(3)	(1)	(1)	(1)	1,734	1,893	2,220	2,556	2,958	3,436	3,847	4,722	5,116
Other machinery, except electrical	351-56,358-59	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	1,183	1,345	1,532	1,818	2,277	2,255	2,122
Electrical equipment	36	608	632	1,017	1,571	2,313	2,491	2,704	2,798	3,081	3,238	3,741	4,515	5,431	6,409	7,048	8,570
Radio and TV receiving equipment	365	(5)	(5)	(5)	(1)	(1)	(1)	(1)	(1)	52	85	102	192	346	358	398	388
Communication equipment	366	230	253	564	930	1,165	1,251	1,287	1,328	1,418	1,559	1,763	2,049	2,367	2,975	3,568	4,357
Electronic components	367					205	260	306	(1)	(1)	(1)	(1)	(1)	1,165	1,212	1,269	1,670
Other electrical equipment	361-64,369	378	379	453	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1,553	1,864	1,813	2,155
Motor vehicles and motor vehicles equipment	371	517	560	799	994	1,661	2,020	2,101	2,022	2,395	2,887	3,381	3,780	4,300	4,219	4,329	4,806
Other transportation equipment	373-75,379					29	33	40	43	(1)	(1)	(1)	(1)	88	80	96	106
Aircraft and missiles	372,376	299	333	452	1,138	978	1,154	1,278	1,285	1,418	1,547	1,823	2,201	2,570	3,440	3,882	3,441
Professional and scientific instruments	38	140	157	202	353	678	801	908	1,004	1,168	1,350	1,668	2,012	2,456	2,978	3,396	3,748
Scientific and mechanical measuring instruments	381-82	59	63	53	67	151	175	211	251	309	405	560	747	1,001	1,235	1,433	1,699
Optical, surgical, photographic, and other instruments	383-87	81	94	149	286	527	626	697	750	859	945	1,108	1,265	1,454	1,743	1,963	2,048
Other manufacturing industries	21,27,31,39	19	33	52	88	(1)	(1)	(1)	198	212	204	266	288	339	411	493	556
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	55	85	172	277	299	305	425	471	541	702	859	1,037	1,048	1,101	1,017
Distribution by size of company (based on number of employees)																	
Less than 1,000	....	[6]375	[6]299	425	459	603	633	691	949	1,085	1,145	1,226	1,375	1,711	1,880	1,997	2,242
1,000 to 4,999	....	[6]406	[6]440	596	666	843	891	992	1,132	1,231	1,289	1,586	1,893	2,257	2,586	3,023	3,381
5,000 to 9,999	....	[6]2,615	[6]2,891	4,338	642	890	981	1,116	1,190	1,334	1,439	1,310	1,463	1,596	2,369	2,271	2,415
10,000 to 24,999	....				6,254	1,540	1,731	1,986	2,262	2,325	2,583	3,203	4,012	4,867	5,537	6,410	6,988
25,000 or more	....					7,659	8,868	9,882	10,049	11,461	12,884	14,790	16,965	20,045	23,056	25,811	27,575

Note: Company funds include all funds for industrial R&D work performed within company facilities except funds provided by the Federal Government. Excluded are company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other nonprofit organizations.

[1] Not separately available but included in total. See general notes.
[2] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.
[3] Data not tabulated at this level prior to 1972.
[4] Data not tabulated at this level prior to 1977.
[5] Included in the other electrical equipment group.
[6] Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table B-6. Company funds for research and development by industry and size of company: 1983

[Dollars in millions]

Industry	SIC code	Total	Companies with total employment of--				
			Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	$42,600	$2,242	$3,381	$2,415	$6,988	$27,575
Food and kindred products	20	799	26	75	130	222	346
Textiles and apparel	22,23	131	(1)	18	22	42	(1)
Lumber, wood products, and furniture	24,25	171	13	43	26	(1)	(1)
Paper and allied products	26	681	(1)	56	30	199	(1)
Chemicals and allied products	28	6,839	242	682	581	2,588	2,745
Industrial chemicals	281-82,286	2,969	76	114	300	384	2,094
Drugs and medicines	283	2,931	(1)	342	175	1,976	(1)
Other chemicals	284-85,287-89	940	(1)	226	106	228	(1)
Petroleum refining and related industries	29	2,032	14	(1)	(1)	218	1,781
Rubber products	30	746	99	136	(1)	195	(1)
Stone, clay, and glass products	32	448	35	(1)	44	222	(1)
Primary metals	33	704	41	143	85	164	271
Ferrous metals and products	331-32,3398-99	420	20	(1)	49	87	(1)
Nonferrous metals and products	333-36	284	21	(1)	36	77	(1)
Fabricated metal products	34	568	88	124	106	86	164
Machinery	35	7,238	539	688	385	890	4,734
Office, computing, and accounting machines	357	5,116	177	326	171	379	4,063
Other machinery, except electrical	351-56,358-59	2,122	362	362	214	511	671
Electrical equipment	36	8,570	439	530	308	1,238	6,055
Radio and TV receiving equipment	365	388	29	25	(1)	(1)	(1)
Communication equipment	366	4,357	121	152	82	401	3,600
Electronic components	367	1,670	162	177	(1)	(1)	799
Other electrical equipment	361-64,369	2,155	127	177	53	(1)	(1)
Motor vehicles and motor vehicles equipment	371	4,806	14	28	60	104	4,601
Other transportation equipment	373-75,379	106	5	18	(1)	(1)	(1)
Aircraft and missiles	372,376	3,441	11	49	81	175	3,125
Professional and scientific instruments	38	3,748	371	330	269	362	2,417
Scientific and mechanical measuring instruments	381-82	1,699	226	240	141	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	2,048	145	90	128	(1)	(1)
Other manufacturing industries	21,27,31,39	556	46	152	74	114	171
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	1,017	216	267	152	122	260

(1) Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-7. Company-financed research and development contracted to outside organizations by industry and size of company: 1983

[Dollars in millions]

Industry and size of company	SIC code	1983
Total	....	$1,002
Distribution by industry		
Food and kindred products	20	8
Textiles and apparel	22,23	14
Lumber, wood products, and furniture	24,25	3
Paper and allied products	26	18
Chemicals and allied products	28	244
Industrial chemicals	281-82,286	76
Drugs and medicines	283	131
Other chemicals	284-85,287-89	37
Petroleum refining and related industries	29	52
Rubber products	30	2
Stone, clay, and glass products	32	5
Primary metals	33	6
Ferrous metals and products	331-32,3398-99	2
Nonferrous metals and products	333-36	4
Fabricated metal products	34	11
Machinery	35	56
Office, computing, and accounting machines	357	33
Other machinery, except electrical	351-56,358-59	23
Electrical equipment	36	130
Radio and TV receiving equipment	365	([1])
Communication equipment	366	81
Electronic components	367	([1])
Other electrical equipment	361-64,369	38
Motor vehicles and motor vehicles equipment	371	([1])
Other transportation equipment	373-75,379	0
Aircraft and missiles	372,376	35
Professional and scientific instruments	38	9
Scientific and mechanical measuring instruments	381-82	5
Optical, surgical, photographic, and other instruments	383-87	4
Other manufacturing industries	21,27,31,39	([1])
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	164
Distribution by size of company (based on number of employees)		
Less than 1,000	....	26
1,000 to 4,999	....	59
5,000 to 9,999	....	78
10,000 to 24,999	....	192
25,000 or more	....	646

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[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-8. Companies with 1,000 or more employees[1] contracting research and development to outside organizations by industry and size of company: 1983

Industry	SIC code	Companies with total employment of--									
		1,000 or more		1,000 to 4,999		5,000 to 9,999		10,000 to 24,999		25,000 or more	
		Total	Outside	Total	Outside	Total	Outside	Total	Outside	Total	Outside
Total	....	1,319	245	807	110	199	36	190	56	123	43
Food and kindred products	20	105	24	51	8	22	6	23	8	9	2
Textiles and apparel	22,23	63	9	37	4	13	1	10	3	3	1
Lumber, wood products, and furniture	24,25	46	2	33	1	9	0	2	0	2	1
Paper and allied products	26	53	13	29	6	8	1	12	3	4	3
Chemicals and allied products	28	109	36	60	16	15	6	24	9	10	5
Industrial chemicals	281-82,286	32	10	13	1	7	3	6	3	6	3
Drugs and medicines	283	32	11	14	4	3	2	12	4	3	1
Other chemicals	284-85,287-89	45	15	33	11	5	1	6	2	1	1
Petroleum refining and related industries.	29	24	10	7	0	2	0	5	3	10	7
Rubber products	30	38	4	28	2	3	1	5	1	2	0
Stone, clay, and glass products	32	37	6	20	2	7	1	8	2	2	1
Primary metals	33	75	15	48	9	9	0	11	4	7	2
Ferrous metals and products	331-32,3398-99	51	8	32	4	7	0	6	2	6	2
Nonferrous metals and products	333-36	24	7	16	5	2	0	5	2	1	0
Fabricated metal products	34	74	8	55	6	11	2	4	0	4	0
Machinery	35	164	25	114	15	21	2	18	4	11	4
Office, computing, and accounting machines	357	41	5	27	3	3	0	5	0	6	2
Other machinery, except electrical	351-56,358-59	123	20	87	12	18	2	13	4	5	2
Electrical equipment	36	143	19	92	11	17	1	19	4	15	3
Radio and TV receiving equipment	365	13	0	8	0	1	0	2	0	2	0
Communication equipment	366	30	2	17	0	3	0	5	1	5	1
Electronic components	367	33	4	22	2	3	0	4	1	4	1
Other electrical equipment	361-64,369	67	13	45	9	10	1	8	2	4	1
Motor vehicles and motor vehicles equipment	371	36	3	20	1	6	0	5	0	5	2
Other transportation equipment	373-75,379	18	4	13	2	2	1	1	0	2	1
Aircraft and missiles	372,376	33	13	12	1	4	1	5	4	12	7
Professional and scientific instruments	38	57	7	38	6	9	1	5	0	5	0
Scientific and mechanical measuring instruments	381-82	30	2	22	1	4	1	2	0	2	0
Optical, surgical, photographic, and other instruments	383-87	27	5	16	5	5	0	3	0	3	0
Other manufacturing industries	21,27,31,39	78	11	50	5	11	2	10	3	7	1
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	166	36	100	15	30	10	23	8	13	3

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[1] Data not available for companies with less than 1,000 employees.

SOURCE: National Science Foundation.

Table B-9. Company financed research and development performed by foreign subsidiaries of U.S. domestic companies outside the United States by selected industry: 1974-83

[Dollars in millions]

Industry	SIC code	1974[1]	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total		$1,300	$1,454	$1,659	$1,877	$2,209	$2,754	$3,165	$3,393	$3,097	$3,234
Food and kindred products	20	27	23	29	32	43	51	54	62	65	65
Chemicals and allied products	28	208	269	312	332	395	500	603	715	684	733
Industrial and other chemicals	281-82,284-89	82	85	108	133	151	199	245	287	313	346
Drugs and medicines	283	126	184	204	199	244	301	357	428	371	387
Petroleum refining and related industries	29	(2)	(2)	(2)	(2)	(2)	(2)	141	194	131	99
Stone, clay, and glass products	32	7	7	(2)	(2)	(2)	(3)	21	18	7	9
Primary metals	33	3	9	12	9	9	11	11	9	9	10
Fabricated metal products	34	(2)	(2)	22	24	29	(3)	(3)	30	25	(3)
Machinery	35	258	331	352	411	460	534	599	612	491	570
Electrical equipment	36	238	245	278	300	352	445	451	475	467	480
Electronic components	367	4	7	9	13	17	25	29	40	36	(3)
Other electrical equipment	361-64,369	(3)	(3)	6	5	9	11	11	39	55	62
Radio and TV receiving equipment; communication equipment	365-66	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Transportation	37	406	412	464	558	640	874	1,020	884	840	859
Motor vehicles and other transportation equipment	371,373-75,379	364	373	423	514	(3)	(3)	(3)	(3)	(3)	(3)
Aircraft and missiles	372,376	42	39	41	44	(3)	(3)	(3)	(3)	(3)	(3)
Professional and scientific instruments	38	39	49	69	81	121	156	186	230	237	(3)
Other manufacturing industries	21-27,30-31,39	111	105	137	144	181	213	139	156	132	145
Nonmanufacturing industries	{07-17,41-67,737, 739,807,891}	3	4	4	9	12	5	7	8	9	15

Note: Data are reported in current U.S. dollars.

[1] Based on data obtained from the top 200 U.S. R&D performing companies.
[2] Included in the other manufacturing industries group.
[3] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-10. Company funds for R&D performance by selected industry: 1983 actual and 1984 projected

[Dollars in millions]

Industry	SIC code	Actual 1983	1984 (projected)
Total		$42,600	$47,053
Chemicals and allied products	28	6,839	7,516
Industrial chemicals	281-82,286	2,969	3,245
Machinery	35	7,238	8,481
Electrical equipment	36	8,570	9,366
Communication equipment	366	4,357	4,556
Motor vehicles and motor vehicles equipment	371	4,806	(1)
Aircraft and missiles	372,376	3,441	4,145
All other industries		11,706	(1)

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation

Table B-11. Federal funds for research and development by industry and size of company: 1957-58, 1963, 1967, and 1972-83

[Dollars in millions]

Industry and size of company	SIC code	1957	1958	1963	1967	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	....	$4,335	$4,759	$7,270	$8,365	$8,017	$8,145	$8,220	$8,605	$9,561	$10,485	$11,189	$12,518	$14,029	$16,382	$18,483	$20,215
Distribution by industry																	
Food and kindred products	20	(1)	6	(2)	2	1	1	1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Textiles and apparel[3]	22,23	(3)	(3)	(2)	(2)	1	1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Lumber, wood products, and furniture[3]	24,25	(3)	(3)	(2)	0	(2)	(2)	(2)	0	0	0	0	0	(2)	0	0	0
Paper and allied products	26	(1)	0	0	(2)	2	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	0	(2)
Chemicals and allied products	28	89	126	234	210	189	203	214	236	266	295	330	346	372	421	434	448
Industrial chemicals	281-82,286	80	110	146	181	171	183	194	218	249	281	325	345	341	409	423	440
Drugs and medicines	283	(1)	2	9	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Other chemicals	284-85,287-89	9	14	79	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Petroleum refining and related industries	29	11	12	21	16	15	14	20	(2)	52	76	121	153	151	(2)	(2)	(2)
Rubber products	30	37	21	46	22	123	146	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Stone, clay, and glass products	32	(2)	(2)	3	2	14	15	14	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Primary metals	33	5	14	10	8	12	11	8	21	26	44	63	95	135	176	279	391
Ferrous metals and products[4]	331-32,3398-99	1	2	2	1	3	4	(2)	3	4	23	43	70	105	(2)	(2)	(2)
Nonferrous metals and products[4]	333-36	4	12	8	6	10	7	(2)	17	22	21	20	25	30	(2)	(2)	(2)
Fabricated metal products	34	38	57	24	13	12	13	14	27	36	44	36	41	49	80	58	66
Machinery	35	272	343	250	322	401	429	511	509	532	477	382	335	647	694	857	1,144
Office, computing, and accounting machines	357	(5)	(5)	(5)	(5)	(2)	(2)	(2)	486	509	435	327	256	(2)	(2)	(2)	(2)
Other machinery, except electrical	351-56,358-59	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	42	55	79	(2)	(2)	(2)	(2)
Electrical equipment	36	1,196	1,337	1,849	2,296	2,367	2,410	2,307	2,307	2,555	2,648	2,766	3,309	3,744	3,920	4,593	5,081
Radio and TV receiving equipment	365	(7)	(7)	(7)	(2)	(2)	(2)	(2)	(2)	0	11	28	53	210	(2)	(2)	(2)
Communication equipment	366	518	615	1,209	1,495	1,417	1,362	1,137	1,057	1,093	1,166	1,236	1,586	1,657	1,783	2,182	2,367
Electronic components	367					125	146	184	(2)	(2)	(2)	(2)	(2)	382	361	391	346
Other electrical equipment	361-64,369	678	722	640	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	1,495	(2)	(2)	(2)
Motor vehicles and motor vehicles equipment	371	190	296	291	360	293	385	288	318	383	471	498	729	655	587	477	566
Other transportation equipment	373-75,379					39	47	47	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Aircraft and missiles	372,376	2,275	2,276	4,261	4,531	3,970	3,899	4,000	4,428	4,921	5,486	5,713	5,840	6,628	8,528	9,776	10,300
Professional and scientific instruments	38	109	137	81	189	161	160	167	172	163	221	330	493	573	637	623	640
Scientific and mechanical measuring instruments	381-82	80	93	16	37	13	11	10	15	15	47	110	203	350	(2)	(2)	(2)
Optical, surgical, photographic, and other instruments	383-87	29	44	65	152	148	149	157	157	148	174	220	290	223	(2)	(2)	(2)
Other manufacturing industries	21,27,31,39	74	72	3	(2)	(2)	(2)	(2)	7	5	39	0	0	25	(2)	(2)	(2)
Nonmanufacturing industries[3]	07-17,41-67,737, 739,807,891	0	62	190	387	431	416	463	310	375	417	527	681	779	858	904	1,048
Distribution by size of company (based on number of employees)																	
Less than 1,000	....	167	[8]233	194	228	326	307	367	273	299	208	212	389	354	424	504	657
1,000 to 4,999	....	226	202	425	351	372	357	378	253	270	237	365	590	444	562	576	641
5,000 to 9,999	....	3,942	[8]4,324	6,651	251	186	187	230	288	313	390	241	228	432	619	485	529
10,000 to 24,999	....				7,536	619	505	430	371	548	835	1,075	1,179	1,150	1,225	1,406	1,597
25,000 or more	....					6,514	6,789	6,815	7,420	8,130	8,815	9,316	10,132	11,648	13,551	15,511	16,791

[1] Less than $0.5 million.
[2] Not separately available but included in total. See general notes.
[3] For 1957 and 1958 textiles and apparel and lumber, wood products, and furniture are included in the nonmanufacturing industries group.
[4] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.
[5] Data not tabulated at this level prior to 1972.
[6] Data not tabulated at this level prior to 1977.
[7] Included in the other electrical equipment group.
[8] Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table B-12. Federal funds for research and development by industry and size of company: 1983

[Dollars in millions]

Industry	SIC code	Total	Companies with total employment of-- Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	$20,215	$657	$641	$529	$1,597	$16,791
Food and kindred products	20	(1)	0	0	0	(1)	0
Textiles and apparel	22,23	(1)	(1)	0	0	0	0
Lumber, wood products, and furniture	24,25	0	0	0	0	0	0
Paper and allied products	26	(1)	0	0	0	(1)	(1)
Chemicals and allied products	28	448	1	(1)	(1)	29	406
Industrial chemicals	281-82,286	440	0	(1)	(1)	24	406
Drugs and medicines	283	(1)	0	(1)	0	(1)	0
Other chemicals	284-85,287-89	(1)	0	0	0	(1)	0
Petroleum refining and related industries	29	(1)	(1)	0	0	(1)	(1)
Rubber products	30	(1)	0	(1)	(1)	(1)	(1)
Stone, clay, and glass products	32	(1)	0	0	0	(1)	(1)
Primary metals	33	391	(1)	2	(1)	8	(1)
Ferrous metals and products	331-32,3398-99	(1)	0	(1)	(1)	(1)	(1)
Nonferrous metals and products	333-36	(1)	(1)	(1)	0	(1)	(1)
Fabricated metal products	34	66	0	23	(1)	(1)	(1)
Machinery	35	1,144	31	19	(1)	(1)	1,083
Office, computing, and accounting machines	357	(1)	(1)	0	0	(1)	(1)
Other machinery, except electrical	351-56,358-59	(1)	(1)	19	(1)	(1)	(1)
Electrical equipment	36	5,081	41	120	153	468	4,299
Radio and TV receiving equipment	365	(1)	(1)	0	0	0	(1)
Communication equipment	366	2,367	(1)	98	(1)	449	1,686
Electronic components	367	346	(1)	(1)	(1)	(1)	(1)
Other electrical equipment	361-64,369	(1)	(1)	(1)	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	566	0	(1)	(1)	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	0	(1)	0	(1)
Aircraft and missiles	372,376	10,300	(1)	104	(1)	532	9,433
Professional and scientific instruments	38	640	(1)	20	(1)	(1)	435
Scientific and mechanical measuring instruments	381-82	(1)	(1)	10	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	10	(1)	0	(1)
Other manufacturing industries	21,27,31,39	(1)	0	0	0	(1)	0
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	1,048	330	317	(1)	(1)	(1)

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-13. Federal funds for research and development by selected industry and agency: 1963-77, 1979, 1981, and 1983

(Dollars in millions)

Industry	SIC code	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1979	1981	1983
Total		$7,270	$7,720	$7,740	$8,332	$8,365	$8,560	$8,451	$7,779	$7,666	$8,017	$8,145	$8,220	$8,605	$9,561	$10,485	$12,518	$16,382	$20,215
Chemicals and allied products	28	234	202	191	188	210	199	192	180	184	189	203	214	236	266	295	346	421	448
Machinery	35	250	246	239	286	322	340	260	262	315	401	429	511	509	532	477	335	694	1,144
Electrical equipment	36	1,849	1,873	1,983	2,201	2,296	2,333	2,390	2,211	2,258	2,367	2,410	2,307	2,307	2,555	2,648	3,309	3,920	5,081
Motor vehicles and other transportation equipment	371,373-75,379	291	322	325	344	360	374	290	314	309	319	424	335	365	(1)	(1)	(1)	(1)	(1)
Aircraft and missiles	372,376	4,261	4,621	4,499	4,724	4,531	4,533	4,524	4,005	3,864	3,970	3,889	4,003	4,434	4,930	5,486	5,840	8,528	10,300
Other industries	--	385	456	503	589	646	781	795	807	736	771	790	850	754	(1)	(1)	(1)	(1)	(1)
DOD[2]																			
Total		$4,700	$4,192	$3,808	$4,241	$5,144	$5,427	$5,688	$5,288	$5,315	$5,818	$6,088	$5,919	$5,812	$6,222	$6,950	$7,939	$10,540	$14,275
Chemicals and allied products	28	(1)	104	63	53	64	64	49	35	40	40	48	39	27	28	32	36	40	55
Machinery	35	148	132	147	227	228	192	182	186	201	250	302	426	405	442	395	541	599	987
Electrical equipment	36	1,200	1,720	1,130	1,292	1,437	1,517	1,584	1,484	1,503	1,663	1,770	1,643	1,570	1,607	1,692	1,920	2,338	3,434
Motor vehicles and other transportation equipment	371,373-75,379	(1)	194	221	229	261	270	242	272	246	232	325	251	288	337	382	(1)	(1)	(1)
Aircraft and missiles	372,376	2,700	2,389	2,006	2,239	2,745	2,811	3,050	2,771	2,848	3,084	3,077	2,992	3,120	3,408	3,900	4,210	6,121	8,033
Other industries	--	(1)	253	241	201	409	573	581	540	477	549	566	568	402	400	461	(1)	(1)	(1)
NASA[2]																			
Total		$1,800	$2,725	$3,166	$3,233	$2,300	$2,311	$1,868	$1,421	$1,391	$1,111	$982	$1,095	$1,409	$1,604	$1,697	$1,786	$2,306	$2,106
Chemicals and allied products	28	(1)	2	1	1	2	5	5	1	3	1	1	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Machinery	35	(1)	91	101	129	79	99	79	78	79	81	78	63	62	62	54	74	81	(1)
Electrical equipment	36	300	264	468	497	404	423	336	274	298	222	181	162	186	200	208	252	317	211
Motor vehicles and other transportation equipment	371,373-75,379	(1)	120	98	97	87	82	33	33	48	58	45	25	27	(1)	(1)	(1)	(1)	(1)
Aircraft and missiles	372,376	1,400	2,084	2,340	2,291	1,595	1,555	1,285	949	898	694	617	789	1,082	1,267	1,348	1,221	1,785	1,771
Other industries	--	(1)	165	163	220	133	147	132	87	65	55	60	(1)	(1)	45	44	119	70	(1)
DOE																			
Total		(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	$1,575	$1,976	$1,909
Chemicals and allied products	28	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(1)	(1)	(1)
Machinery	35	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(1)	(1)	(1)
Electrical equipment	36	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	784	951	1,030
Motor vehicles and other transportation equipment	371,373-75,379	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	16	20	28
Aircraft and missiles	372,376	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	253	340	187
Other industries	--	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	287	356	275

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[1] Not separately available but included in total. See general notes.

[2] For 1963-74, funds were based on approximately 175 companies leading in Federal F&D funds; 1975-83 funds are based on all companies reporting Federal R&D funds.

[3] Data not tabulated for this agency prior to 1979.

SOURCE: National Science Foundation.

Table B-14. R&D-performing companies with 1,000 or more employees[1] and number with Federal R&D funds by industry and size of company: 1983

Industry	SIC code	Companies with total employment of--									
		1,000 or more		1,000 to 4,999		5,000 to 9,999		10,000 to 24,999		25,000 or more	
		Total	Federal	Total	Federal	Total	Federal	Total	Federal	Total	Federal
Total	....	1,319	214	807	71	199	30	190	48	123	65
Food and kindred products	20	105	1	51	0	22	0	23	1	9	0
Textiles and apparel	22,23	63	2	37	1	13	1	10	0	3	0
Lumber, wood products, and furniture	24,25	46	0	33	0	9	0	2	0	2	0
Paper and allied products	26	53	3	29	0	8	0	12	2	4	1
Chemicals and allied products	28	109	21	60	3	15	2	24	9	10	7
Industrial chemicals	281-82,286	32	14	13	2	7	2	6	4	6	6
Drugs and medicines	283	32	5	14	1	3	0	12	3	3	1
Other chemicals	284-85,287-89	45	2	33	0	5	0	6	2	1	0
Petroleum refining and related industries	29	24	10	7	0	2	0	5	2	10	8
Rubber products	30	38	6	28	2	3	1	5	2	2	1
Stone, clay, and glass products	32	37	4	20	0	7	0	8	3	2	1
Primary metals	33	75	14	48	5	9	2	11	3	7	4
Ferrous metals and products	331-32,3398-99	51	8	32	2	7	2	6	1	6	3
Nonferrous metals and products	333-36	24	6	16	3	2	0	5	2	1	1
Fabricated metal products	34	74	11	55	4	11	3	4	2	4	2
Machinery	35	164	15	114	7	21	2	18	2	11	4
Office, computing, and accounting machines	357	41	3	27	0	3	0	5	1	6	2
Other machinery, except electrical	351-56,358-59	123	12	87	7	18	2	13	1	5	2
Electrical equipment	36	143	38	92	15	17	4	19	7	15	12
Radio and TV receiving equipment	365	13	1	8	0	1	0	2	0	2	1
Communication equipment	366	30	17	17	7	3	2	5	3	5	5
Electronic components	367	33	11	22	4	3	1	4	2	4	4
Other electrical equipment	361-64,369	67	9	45	4	10	1	8	2	4	2
Motor vehicles and motor vehicles equipment	371	36	9	20	1	6	2	5	2	5	4
Other transportation equipment	373-75,379	18	3	13	0	2	1	1	0	2	2
Aircraft and missiles	372,376	33	26	12	7	4	2	5	5	12	12
Professional and scientific instruments	38	57	20	38	12	9	2	5	2	5	4
Scientific and mechanical measuring instruments	381-82	30	12	22	7	4	1	2	2	2	2
Optical, surgical, photographic, and other instruments	383-87	27	8	16	5	5	1	3	0	3	2
Other manufacturing industries	21,27,31,39	78	1	50	0	11	0	10	1	7	0
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	166	30	100	14	30	8	23	5	13	3

[1] Data not available for companies with less than 1,000 employees.

SOURCE: National Science Foundation.

Table B-15. Industry-administered federally funded research and development centers--composition of work force and funds by character of work: 1982-83

[Dollars in millions]

Item	1982	1983
Total R&D funds[1]..........	$1,484	$1,589
Basic research..........	(2)	119
Applied research.......	(2)	415
Development............	(2)	1,055
	January	
	1983	1984
Full-time-equivalent R&D scientists and engineers	8,057	8,164
	March	
	1982	1983
Total employment.........	25,100	24,447

[1] All of these funds were devoted to Federal R&D activities.

(2) Data not collected for 1982.

SOURCE: National Science Foundation.

Table B-16. R&D-performing companies in manufacturing and nonmanufacturing industries by size of company: 1983

Size of company (based on number of employees)	Number of companies reporting R&D funds		
	Total	Manufacturing	Nonmanufacturing
Total..............................	13,819	(1)	(1)
Less than 1,000.........................	[2]12,500	(1)	(1)
1,000 to 4,999..........................	807	707	100
5,000 to 9,999..........................	199	169	30
10,000 to 24,999........................	190	167	23
25,000 or more..........................	123	110	13

[1] Not separately available but included in total. See general notes.

[2] Estimated by the Census Bureau based on the 1981 survey of companies with fewer than 1,000 employees. This figure is not comparable to estimates published in earlier volumes due to a change in the estimating procedure used to derive this number.

SOURCE: National Science Foundation.

Table B-17. R&D-performing companies with 1,000 or more employees[1] by size of company and R&D program: 1983

Size of company (based on number of employees)	Total	Size of R&D program [Dollars in thousands]				
		Less than $200	$200 to $999	$1,000 to $9,999	$10,000 to $99,999	$100,000 or more
Total..............................	1,319	125	275	525	308	86
1,000 to 4,999..........................	807	104	229	372	102	0
5,000 to 9,999..........................	199	13	26	93	65	2
10,000 to 24,999........................	190	6	13	49	98	24
25,000 or more..........................	123	2	7	11	43	60

[1] Data not available for companies with less than 1,000 employees.

SOURCE: National Science Foundation.

Table B-18. R&D-performing manufacturing companies with 5,000 or more employees by industry and percent change in R&D funds: 1982-83

Industry	SIC code	Total number of companies	10 percent or more increase	10 percent or more decrease	Less than 10 percent change
Total	....	446	193	87	166
Food and kindred products	20	54	18	14	22
Textiles and apparel	22,23	26	10	3	13
Lumber, wood products, and furniture	24,25	13	4	3	6
Paper and allied products	26	24	13	5	6
Chemicals and allied products	28	49	26	3	20
Industrial chemicals	281-82,286	19	4	3	12
Drugs and medicines	283	18	16	0	2
Other chemicals	284-85,287-89	12	6	0	6
Petroleum refining and related industries	29	17	8	5	4
Rubber products	30	10	7	0	3
Stone, clay, and glass products	32	17	8	2	7
Primary metals	33	27	6	12	9
Ferrous metals and products	331-32,3398-99	19	5	8	6
Nonferrous metals and products	333-36	8	1	4	3
Fabricated metal products	34	19	11	2	6
Machinery	35	50	11	15	24
Office, computing, and accounting machines	357	14	6	2	6
Other machinery, except electrical	351-56,358-59	36	5	13	18
Electrical equipment	36	51	28	4	19
Radio and TV receiving equipment	365	5	1	1	3
Communication equipment	366	13	7	1	5
Electronic components	367	11	8	2	1
Other electrical equipment	361-64,369	22	12	0	10
Motor vehicles and motor vehicles equipment	371	16	9	3	4
Other transportation equipment	373-75,379	5	0	3	2
Aircraft and missiles	372,376	21	10	5	6
Professional and scientific instruments	38	19	9	3	7
Scientific and mechanical measuring instruments	381-82	8	6	0	2
Optical, surgical, photographic, and other instruments	383-87	11	3	3	5
Other manufacturing industries	21,27,31,39	28	15	5	8

Note: Manufacturing companies with 5,000 or more employees are classified into those increasing 10 percent or more, those decreasing 10 percent or more, or those changing less than 10 percent based on their ratio of change for total R&D funds between 1982 and 1983.

SOURCE: National Science Foundation.

Table B-19. Percent of total, Federal, and company funds of R&D-performing companies ranked by size of R&D program: 1972-83

Companies ranked by size of R&D program (based on total R&D funds)[1]	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
	Percent of total R&D funds											
First 4 (1-4)	18	19	20	20	20	20	19	20	17	18	20	20
Next 4 (5-8)	16	15	15	15	14	14	14	13	14	12	12	12
Next 12 (9-20)	21	22	21	19	20	19	19	19	18	20	19	19
Next 20 (21-40)	12	11	11	12	12	13	13	13	13	12	13	13
Next 60 (41-100)	13	13	15	15	15	15	15	15	15	18	16	16
Next 100 (101-200)	7	8	8	8	8	9	9	9	9	9	9	9
Next 200 (201-400)	6	6	6	6	6	6	6	6	6	6	6	6
	Percent of Federal R&D funds											
First 4 (1-4)	10	10	19	21	19	20	17	10	14	20	22	20
Next 4 (5-8)	32	31	22	23	23	23	24	27	20	18	19	20
Next 12 (9-20)	29	30	31	29	30	30	31	34	32	31	29	29
Next 20 (21-40)	16	15	11	12	11	12	11	11	15	13	12	13
Next 60 (41-100)	7	7	9	9	12	12	13	12	12	12	12	12
Next 100 (101-200)	2	3	4	4	3	3	4	4	4	3	4	4
Next 200 (201-400)	3	3	2	2	2	1	1	2	3	3	2	2
	Percent of company R&D funds											
First 4 (1-4)	24	25	20	19	20	20	20	24	18	18	18	20
Next 4 (5-8)	5	5	11	10	9	8	9	7	11	10	7	7
Next 12 (9-20)	15	15	13	13	13	13	13	12	12	14	15	14
Next 20 (21-40)	9	9	11	11	12	13	13	14	12	12	14	14
Next 60 (41-100)	17	17	17	17	17	16	16	17	17	17	17	18
Next 100 (101-200)	11	11	11	10	11	12	11	11	11	11	12	11
Next 200 (201-400)	8	8	8	8	8	8	8	8	8	8	8	8

[1] Companies were ranked individually for each year; therefore, particular companies comprising the size groups may have changed from year to year.

SOURCE: National Science Foundation.

Table B-20. Net sales of R&D-performing companies by industry and size of company: 1982-83

[Dollars in millions]

Industry	SIC code	1982						1983					
			Companies with total employment of--						Companies with total employment of--				
		Total	Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more	Total	Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	$1,690,251	$104,922	$188,636	$179,139	$366,325	$851,229	$1,829,145	$143,365	$201,366	$198,977	$383,224	$902,213
Food and kindred products	20	174,073	12,174	24,397	31,115	65,056	41,331	184,871	13,252	27,730	31,486	67,961	44,443
Textiles and apparel	22,23	26,676	3,882	4,133	4,591	7,886	6,183	28,857	3,350	4,873	5,156	8,683	6,795
Lumber, wood products, and furniture	24,25	18,789	2,637	4,216	4,622	(1)	(1)	20,982	1,959	5,048	(1)	(1)	(1)
Paper and allied products	26	53,131	2,708	6,568	4,989	22,121	16,746	59,896	2,917	7,348	5,712	24,816	19,103
Chemicals and allied products	28	156,402	11,188	17,416	17,335	42,507	67,955	167,001	11,327	18,259	19,231	45,990	72,194
Industrial chemicals	281-82,286	82,827	3,256	4,762	10,409	12,769	51,632	88,379	3,170	5,068	11,197	14,183	54,760
Drugs and medicines	283	35,261	(1)	3,920	2,334	20,408	(1)	38,407	(1)	4,287	2,781	21,973	(1)
Other chemicals	284-85,287-89	38,313	(1)	8,735	4,592	9,330	(1)	40,215	(1)	8,904	5,253	9,834	(1)
Petroleum refining and related industries	29	264,076	(1)	7,719	(1)	52,056	199,733	294,991	38,016	6,739	8,242	47,487	194,507
Rubber products	30	30,994	4,099	5,386	1,636	10,359	9,515	34,261	5,078	5,877	1,694	11,410	10,202
Stone, clay, and glass products	32	27,246	3,415	3,103	(1)	10,330	(1)	31,206	4,546	3,575	5,661	11,768	5,656
Primary metals	33	88,748	4,340	12,200	7,676	23,162	41,370	86,731	4,334	11,990	7,100	24,338	38,969
Ferrous metals and products	331-32,3398-99	64,236	(1)	6,918	(1)	12,756	37,455	60,311	(1)	6,292	(1)	12,857	34,377
Nonferrous metals and products	333-36	24,512	(1)	5,282	(1)	10,406	3,915	26,420	(1)	5,698	(1)	11,480	4,593
Fabricated metal products	34	42,941	7,655	10,800	7,064	5,033	12,389	41,440	6,756	11,121	7,298	5,324	10,941
Machinery	35	143,237	18,237	21,823	28,661	23,981	50,536	145,161	18,880	23,551	27,591	22,994	52,145
Office, computing, and accounting machines	357	45,839	(1)	3,621	(1)	5,378	33,565	51,479	2,245	4,654	1,444	6,007	37,129
Other machinery, except electrical	351-56,358-59	97,398	(1)	18,202	(1)	18,603	16,971	93,682	16,635	18,897	26,147	16,987	15,016
Electrical equipment	36	150,344	9,288	13,926	7,422	24,650	95,060	159,135	9,964	15,524	9,879	26,261	97,507
Radio and TV receiving equipment	365	13,760	961	795	(1)	(1)	(1)	16,867	1,021	989	(1)	(1)	(1)
Communication equipment	366	50,145	1,702	2,696	1,441	6,090	38,217	51,358	1,892	2,911	1,559	6,459	38,538
Electronic components	367	24,740	2,862	3,137	(1)	(1)	(1)	25,864	2,924	3,299	(1)	(1)	(1)
Other electrical equipment	361-64,369	61,699	3,762	7,298	4,348	10,350	35,941	65,045	4,128	8,325	5,107	10,822	36,663
Motor vehicles and motor vehicles equipment	371	104,714	1,766	2,983	4,211	6,678	89,076	133,003	1,683	3,956	5,074	9,085	113,205
Other transportation equipment	373-75,379	15,140	(1)	5,907	(1)	(1)	(1)	10,930	705	4,548	(1)	(1)	(1)
Aircraft and missiles	372,376	77,083	952	1,984	2,956	6,063	65,129	86,713	865	2,134	2,612	7,160	73,942
Professional and scientific instruments	38	45,402	6,369	5,374	5,017	4,083	24,558	47,229	6,733	5,662	4,741	4,056	26,038
Scientific and mechanical measuring instruments	381-82	18,670	3,691	2,576	2,478	(1)	(1)	19,386	3,673	2,849	(1)	(1)	8,353
Optical, surgical, photographic, and other instruments	383-87	26,732	2,678	2,798	2,540	(1)	(1)	27,843	3,060	2,812	(1)	(1)	17,685
Other manufacturing industries	21,27,31,39	60,348	4,378	10,398	8,427	9,799	27,346	64,127	4,470	10,532	7,974	10,488	30,662
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	210,908	8,671	30,304	34,402	49,378	88,153	232,610	8,530	32,898	42,386	52,143	96,652

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-21. R&D funds as a percent of net sales in R&D-performing manufacturing companies by industry and size of company: 1957-58, 1963, 1967, and 1972-83

[Dollars in millions]

Industry and size of company	SIC code	1957	1958	1963	1967	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	....	3.4	3.8	4.5	4.2	3.4	3.3	3.1	3.1	3.1	2.9	2.9	2.6	3.0	3.1	3.8	3.8
Distribution by industry																	
Food and kindred products	20	.3	.3	.4	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4	(1)	(1)	(1)
Textiles and apparel	22,23	(1)	.3	.5	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4	(1)	(1)	(1)
Lumber, wood products, and furniture	24,25	(1)	.4	.5	.3	.8	.7	.8	.7	.7	.8	.7	.7	.8	.8	.9	.8
Paper and allied products	26	.6	.7	.8	.9	.8	.7	.8	.9	1.0	.9	.9	1.0	1.0	(1)	1.2	(1)
Chemicals and allied products	28	3.5	3.8	4.3	4.6	3.6	3.5	3.5	3.7	3.7	3.6	3.6	3.5	3.6	3.6	4.3	4.4
Industrial chemicals	281-82,286	5.0	5.4	5.1	4.8	3.9	3.6	3.3	3.6	3.7	3.5	3.5	3.2	3.3	3.2	4.0	3.9
Drugs and medicines	283	3.6	4.1	4.7	6.1	6.5	6.5	6.3	6.4	6.3	6.4	6.2	6.1	6.2	(1)	(1)	(1)
Other chemicals	284-85,287-89	1.3	1.5	2.8	2.3	1.7	1.6	1.6	1.7	1.7	1.8	1.8	1.8	1.9	(1)	(1)	(1)
Petroleum refining and related industries	29	.7	1.1	1.0	.8	.8	.7	.6	.7	.6	.7	.7	.7	.6	(1)	(1)	(1)
Rubber products	30	1.7	1.8	2.3	1.9	2.6	2.6	2.5	2.5	2.4	2.1	1.9	1.9	2.2	(1)	(1)	(1)
Stone, clay, and glass products	32	(2)	(2)	1.6	1.8	1.7	1.7	1.7	1.2	1.2	1.3	1.3	1.3	1.4	(1)	(1)	(1)
Primary metals	33	.5	.7	.8	.8	.7	.7	.6	.8	.8	.7	.7	.6	.7	.9	1.1	1.3
Ferrous metals and products[3]	331-32,3398-99	(1)	.6	.7	.8	.6	.5	.5	.6	.6	.6	.6	.6	.7	(1)	(1)	(1)
Nonferrous metals and products[3]	333-36	(1)	.7	1.1	1.0	.9	.9	1.0	1.2	1.2	1.0	.8	.7	.7	(1)	(1)	(1)
Fabricated metal products	34	1.6	1.7	1.6	1.3	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.4	1.4	1.3	1.5
Machinery	35	3.4	3.8	4.2	4.2	4.3	4.6	4.6	4.8	4.9	4.9	4.6	4.5	5.0	4.9	5.5	5.8
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	11.1	11.6	12.6	12.0	11.6	11.5	11.1	11.0	12.0	(1)	(1)	(1)
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	2.2	2.1	2.1	2.3	(1)	(1)	(1)
Electrical equipment	36	7.6	10.3	10.1	8.6	7.1	6.9	6.6	6.5	6.7	6.9	5.8	6.0	6.6	6.8	7.7	8.6
Radio and TV receiving equipment	365	(6)	(6)	(6)	1.9	1.6	1.7	1.7	1.4	1.4	1.8	1.8	2.5	4.3	(1)	(1)	(1)
Communication equipment	366	(1)	11.3	13.0	10.3	8.7	8.1	7.6	7.6	7.6	7.7	7.7	8.8	9.1	9.6	11.5	13.1
Electronic components	367					5.9	6.2	6.2	6.9	7.3	6.8	6.7	7.1	7.9	7.4	6.7	7.8
Other electrical equipment	361-64,369	(1)	9.7	7.3	7.3	6.3	6.3	6.3	6.0	6.3	5.2	5.1	4.9	4.9	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	2.9	4.2	3.4	3.4	3.3	3.5	3.7	3.5	3.2	3.1	3.3	3.8	4.9	4.5	4.6	4.0
Other transportation equipment	373-75,379					1.0	1.2	1.3	1.3	1.3	1.2	.8	.8	.6	(1)	(1)	(1)
Aircraft and missiles	372,376	16.8	17.7	26.7	19.7	16.6	13.3	14.1	12.7	12.7	13.3	13.3	12.9	13.7	16.0	17.7	15.8
Professional and scientific instruments	38	7.0	7.8	5.9	5.4	5.9	6.1	6.1	5.9	6.2	6.3	6.9	7.3	7.5	8.1	8.9	9.3
Scientific and mechanical measuring instruments	381-82	9.5	10.2	4.1	3.9	4.1	4.3	4.5	4.9	5.4	6.3	7.1	7.3	8.4	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	5.2	6.3	6.9	6.0	6.6	6.8	6.7	6.1	6.4	6.4	6.8	7.2	6.9	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	(1)	1.3	.7	.6	.8	.8	.9	.8	.7	.6	.5	.4	.4	(1)	(1)	(1)
Distribution by size of company (based on number of employees)																	
Less than 1,000	....	1.8	1.3	1.9	1.7	1.7	1.6	1.8	1.6	1.7	1.5	1.6	1.6	1.4	1.5	2.1	1.7
1,000 to 4,999	....	[7]1.8	1.8	2.4	1.7	1.7	1.6	1.5	1.4	1.4	1.6	1.6	1.8	1.8	1.7	1.9	2.0
5,000 to 9,999	....	[7]3.9	4.8	5.3	2.1	1.9	1.8	1.8	1.8	1.9	2.0	1.4	1.3	1.4	2.1	1.7	1.7
10,000 to 24,999	....				5.2	1.9	1.7	1.6	1.7	1.8	1.9	1.9	1.7	1.7	1.9	2.4	2.5
25,000 or more	....					4.7	4.5	4.2	4.5	4.2	4.2	4.0	3.8	4.0	4.6	5.4	5.5

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[1] Not separately available but included in total. See general notes.

[2] Included in other manufacturing industries group.

[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.

[4] Data not tabulated at this level prior to 1972.

[5] Data not tabulated at this level prior to 1977.

[6] Included in the other electrical equipment group.

[7] Separate data for companies with 5,000 or more employees and for companies with 1,000 to 4,999 employees were estimated by the National Science Foundation for 1957. Revisions of statistics by the U.S. Bureau of the Census for this year did not yield separate data for companies in these size groups.

SOURCE: National Science Foundation.

Table B-22. Company R&D funds as a percent of net sales in R&D-performing manufacturing companies by industry and size of company: 1957-58, 1963, 1967, and 1972-83

[Dollars in millions]

Industry and size of company	SIC code	1957	1958	1963	1967	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	....	1.5	1.6	1.9	2.1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	2.1	2.2	2.6	2.6
Distribution by industry																	
Food and kindred products	20	.3	.3	(1)	.5	.4	.4	.4	(1)	(1)	(1)	(1)	(1)	(1)	.4	.4	.4
Textiles and apparel	22,23	(1)	.2	.4	(1)	.4	.4	(1)	(1)	(1)	(1)	(1)	(1)	(1)	.4	.5	.5
Lumber, wood products, and furniture	24,25	(1)	.4	(1)	.3	(1)	(1)	(1)	.7	.7	.8	.7	.7	.8	.8	.9	.8
Paper and allied products	26	.6	.7	.8	(1)	.8	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1.0	1.0	1.2	1.1
Chemicals and allied products	28	3.1	3.2	3.6	4.0	3.3	3.1	3.0	3.1	3.3	3.3	3.2	3.2	3.3	3.4	4.0	4.1
Industrial chemicals	281-82,286	4.2	4.3	4.1	3.9	3.2	3.0	2.8	3.1	3.1	3.0	2.9	2.6	2.8	2.8	3.5	3.4
Drugs and medicines	283	3.6	4.0	4.5	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	6.1	6.3	7.1	7.6
Other chemicals	284-85,287-89	1.2	1.3	1.8	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1.9	2.1	2.2	2.3
Petroleum refining and related industries	29	.7	1.1	1.2	.8	.7	.7	.5	(1)	.6	.6	.7	.6	.5	.6	.8	.7
Rubber products	30	1.1	1.4	1.6	1.7	1.7	1.7	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1.9	2.2	2.2
Stone, clay, and glass products	32	(2)	(2)	1.6	1.7	1.6	1.5	1.5	(1)	(1)	(1)	(1)	(1)	1.3	1.4	1.5	1.4
Primary metals	33	.5	.6	.7	.8	.7	.6	.5	.7	.8	.7	.6	.5	.5	.7	.8	.8
Ferrous metals and products[3]	331-32,3398-99	(1)	.6	.7	.7	.6	.5	(1)	.6	.6	.6	.5	.5	.5	.6	.7	.7
Nonferrous metals and products[3]	333-36	(1)	.6	.9	.9	.9	.8	(1)	1.1	1.1	.9	.8	.6	.6	1.0	1.2	1.1
Fabricated metal products	34	1.1	1.1	1.4	1.2	1.1	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.2	1.2	1.2	1.4
Machinery	35	2.0	2.1	3.1	3.2	3.5	3.8	3.8	4.0	4.2	4.3	4.2	4.2	4.5	4.4	4.9	5.0
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	(1)	(1)	(1)	9.4	9.1	9.6	9.8	10.1	10.4	9.7	10.3	9.9
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	2.1	2.0	2.0	2.2	2.3	2.3	2.3
Electrical equipment	36	2.6	3.3	3.6	3.5	3.5	3.5	3.5	3.6	3.7	3.4	3.4	3.6	3.9	4.2	4.7	5.4
Radio and TV receiving equipment	365	(6)	(6)	(6)	(1)	(1)	(1)	(1)	1.4	1.4	1.6	1.4	1.7	2.7	2.6	2.9	2.3
Communication equipment	366	(1)	3.3	4.2	3.9	3.9	3.9	3.9	4.2	4.3	4.4	4.5	5.0	5.4	6.0	7.1	8.5
Electronic components	367					3.7	3.9	3.9	(1)	(1)	(1)	(1)	(1)	5.9	5.7	5.1	6.5
Other electrical equipment	361-64,369	(1)	3.3	3.0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	2.5	2.8	2.9	3.3
Motor vehicles and motor vehicles equipment	371	2.1	2.8	2.5	2.5	2.8	2.9	3.2	3.0	2.7	2.7	2.9	3.2	4.2	3.9	4.1	3.6
Other transportation equipment	373-75,379					.6	.6	.6	.6	.6	.7	(1)	(1)	.3	.3	.6	1.0
Aircraft and missiles	372,376	2.0	2.3	2.6	4.0	3.3	3.0	3.5	2.8	2.8	2.9	3.2	3.5	3.8	4.6	5.0	3.9
Professional and scientific instruments	38	3.9	4.1	4.2	3.5	4.8	5.1	5.2	5.1	5.4	5.4	5.7	5.8	6.1	6.7	7.5	7.9
Scientific and mechanical measuring instruments	381-82	4.0	4.0	3.1	2.5	3.8	4.0	4.4	4.7	5.3	5.7	5.9	5.8	6.2	6.9	7.7	8.8
Optical, surgical, photographic, and other instruments	383-87	3.8	4.1	4.8	3.9	5.1	5.5	5.5	5.2	5.5	5.4	5.6	5.9	6.0	6.6	7.3	7.4
Other manufacturing industries	21,27,31,39	(1)	(1)	.6	(1)	(1)	(1)	(1)	.7	.7	.6	.5	.4	.4	.4	.8	.9
Distribution by size of company (based on number of employees)																	
Less than 1,000	....	1.4	.7	1.5	1.6	1.5	1.5	1.6	1.4	1.5	1.5	1.4	1.5	1.2	1.4	1.8	1.5
1,000 to 4,999	....	[7]1.2	1.3	1.5	1.4	1.3	1.3	1.2	1.2	1.2	1.4	1.4	1.4	1.4	1.5	1.7	1.8
5,000 to 9,999	....	[7]1.6	1.9	2.1	1.6	1.5	1.5	1.4	1.5	1.6	1.5	1.2	1.1	1.1	1.7	1.5	1.4
10,000 to 24,999	....				2.3	1.4	1.3	1.3	1.5	1.4	1.4	1.4	1.4	1.4	1.6	2.0	2.1
25,000 or more	....					2.5	2.5	2.4	2.6	2.5	2.4	2.5	2.4	2.5	2.7	3.3	3.4

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[1] Not separately available but included in total. See general notes.
[2] Data included in other manufacturing industries group.
[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.
[4] Data not tabulated at this level prior to 1972.
[5] Data not tabulated at this level prior to 1977.
[6] Included in the other electrical equipment group.
[7] Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table B-23. R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of R&D program by industry: 1983

Industry	SIC code	First 4 companies	Next 4 companies	Next 12 companies
Total	....	11.5	11.0	8.4
Food and kindred products	20	1.2	.9	.6
Textiles and apparel	22,23	.9	.5	.4
Lumber, wood products, and furniture	24,25	1.4	.8	.7
Paper and allied products	26	3.3	1.4	.5
Chemicals and allied products	28	4.8	5.6	7.6
Industrial chemicals	281-82,286	4.8	5.2	2.9
Drugs and medicines	283	11.8	8.0	6.1
Other chemicals	284-85,287-89	3.4	2.9	1.7
Petroleum refining and related industries	29	1.2	.8	.5
Rubber products	30	4.4	2.8	2.6
Stone, clay, and glass products	32	4.4	1.3	.9
Primary metals	33	1.9	1.2	1.4
Ferrous metals and products	331-32,3398-99	1.8	2.5	.6
Nonferrous metals and products	333-36	1.3	2.2	1.0
Fabricated metal products	34	3.4	1.2	1.8
Machinery	35	13.7	6.9	7.0
Office, computing, and accounting machines	357	13.9	10.3	7.0
Other machinery, except electrical	351-56,358-59	6.8	3.9	3.9
Electrical equipment	36	15.3	6.7	9.6
Radio and TV receiving equipment	365	4.7	1.2	2.5
Communication equipment	366	14.1	13.1	10.5
Electronic components	367	9.6	12.5	4.7
Other electrical equipment	361-64,369	10.6	4.3	2.0
Motor vehicles and motor vehicles equipment	371	4.5	3.9	1.3
Other transportation equipment	373-75,379	3.8	.4	.3
Aircraft and missiles	372,376	23.4	16.6	8.1
Professional and scientific instruments	38	11.4	12.3	7.5
Scientific and mechanical measuring instruments	381-82	14.3	8.8	8.4
Optical, surgical, photographic, and other instruments	383-87	9.8	7.6	4.2
Other manufacturing industries	21,27,31,39	1.1	3.2	.9

SOURCE: National Science Foundation.

Table B-24. Company R&D funds as a percent of net sales in R&D-performing manufacturing companies ranked by size of net sales by industry: 1983

[Dollars in millions]

Industry	SIC code	Company R&D funds		Net sales		Company R&D funds as a percent of net sales	
		First 8 companies	Next 12 companies	First 8 companies	Next 12 companies	First 8 companies	Next 12 companies
Total..	....	$8,773	$3,020	$263,115	$203,666	3.3	1.5
Food and kindred products..........................	20	258	201	60,332	41,805	.4	.5
Textiles and apparel...............................	22,23	54	29	12,141	6,839	.4	.4
Lumber, wood products, and furniture...............	24,25	105	33	11,936	4,370	.9	.8
Paper and allied products..........................	26	417	165	30,150	17,124	1.4	1.0
Chemicals and allied products......................	28	2,364	1,517	68,578	31,526	3.4	4.8
Industrial chemicals.............................	281-82,286	2,127	657	62,745	18,667	3.4	3.5
Drugs and medicines..............................	283	1,366	1,220	20,069	13,815	6.8	8.8
Other chemicals..................................	284-85,287-89	512	178	20,735	8,073	2.5	2.2
Petroleum refining and related industries..........	29	1,697	315	175,827	115,874	1.0	.3
Rubber products....................................	30	494	110	22,259	4,630	2.2	2.4
Stone, clay, and glass products....................	32	317	68	15,663	8,591	2.0	.8
Primary metals.....................................	33	291	164	44,089	22,552	.7	.7
Ferrous metals and products......................	331-32,3398-99	220	121	40,607	11,845	.5	1.0
Nonferrous metals and products...................	333-36	164	75	19,407	4,640	.8	1.6
Fabricated metal products..........................	34	240	113	16,297	8,571	1.5	1.3
Machinery..	35	4,385	736	60,186	22,901	7.3	3.2
Office, computing, and accounting machines.......	357	4,122	645	40,765	5,899	10.1	10.9
Other machinery, except electrical...............	351-56,358-59	755	421	35,646	15,179	2.1	2.8
Electrical equipment...............................	36	5,138	1,345	79,013	31,315	6.5	4.3
Radio and TV receiving equipment.................	365	(1)	29	(1)	817	2.2	3.5
Communication equipment..........................	366	3,946	233	42,929	5,551	9.2	4.2
Electronic components............................	367	(1)	253	(1)	3,909	6.5	6.5
Other electrical equipment.......................	361-64,369	1,582	265	43,914	8,768	3.6	3.0
Motor vehicles and motor vehicles equipment........	371	4,697	72	120,331	8,487	3.9	.8
Other transportation equipment.....................	373-75,379	91	11	8,581	2,078	1.1	.5
Aircraft and missiles..............................	372,376	2,612	656	60,983	22,420	4.3	2.9
Professional and scientific instruments............	38	2,697	357	29,335	6,481	9.2	5.5
Scientific and mechanical measuring instruments..	381-82	1,233	155	12,864	2,099	9.6	7.4
Optical, surgical, photographic, and other instruments......................................	383-87	1,766	100	21,312	2,952	8.3	3.4
Other manufacturing industries.....................	21,27,31,39	187	161	32,846	13,108	.6	1.2

[1] Not separately available but icluded in total. See general notes.

SOURCE: National Science Foundation.

Table B-25. Percent of net sales and employment of R&D-performing companies ranked by size of R&D program: 1972-83

Companies ranked by size of R&D program (based on total R&D funds)[1]	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
	Percent of net sales											
First 4 (1-4)...........................	10	9	6	6	9	9	9	9	5	5	6	7
Next 4 (5-8)............................	3	3	5	5	3	3	3	3	4	4	4	4
Next 12 (9-20)..........................	6	6	5	6	6	6	6	5	8	9	9	8
Next 20 (21-40).........................	7	7	11	10	10	10	10	11	7	7	7	8
Next 60 (41-100)........................	16	17	16	16	16	14	14	14	17	17	16	15
Next 100 (101-200)......................	14	14	14	12	11	14	14	14	12	13	15	14
Next 200 (201-400)......................	15	16	17	15	16	16	17	17	14	13	17	17
	Percent of employment											
First 4 (1-4)...........................	9	8	7	7	8	8	8	9	7	7	7	7
Next 4 (5-8)............................	4	4	5	5	4	4	4	4	4	4	4	4
Next 12 (9-20)..........................	7	7	6	6	7	7	7	7	7	7	7	7
Next 20 (21-40).........................	8	8	9	8	9	8	8	8	8	8	8	9
Next 60 (41-100)........................	12	12	13	13	13	13	12	12	13	12	11	12
Next 100 (101-200)......................	12	12	11	11	11	13	13	13	13	13	14	14
Next 200 (201-400)......................	16	16	16	15	16	15	15	16	14	14	18	18

[1] Companies were ranked individually for each year; therefore, particular companies comprising the size groups may have changed from year to year.

SOURCE: National Science Foundation.

Table B-26. Percent of total and Federal R&D funds and of net sales of R&D-performing companies ranked by size of R&D program by industry: 1983

Industry	SIC code	Percent of total R&D funds			Percent of Federal R&D funds			Percent of net sales of all R&D performing companies		
		First 4 companies	Next 4	Next 12	First 4 companies	Next 4	Next 12	First 4 companies	Next 4	Next 12
Total	....	20	12	19	20	20	29	7	4	8
Food and kindred products	20	28	15	27	0	0	100	10	7	21
Textiles and apparel	22,23	39	12	18	0	0	7	19	11	22
Lumber, wood products, and furniture	24,25	61	10	16	0	0	0	36	9	17
Paper and allied products	26	66	12	14	58	5	37	23	9	34
Chemicals and allied products	28	30	15	25	84	7	2	27	11	15
Industrial chemicals	281-82,286	63	18	14	85	8	5	50	13	24
Drugs and medicines	283	32	21	37	7	63	1	21	20	47
Other chemicals	284-85,287-89	51	9	18	83	0	4	36	7	25
Petroleum refining and related industries	29	57	29	14	7	89	3	34	25	22
Rubber products	30	65	13	9	96	([1])	3	44	13	11
Stone, clay, and glass products	32	64	17	11	99	1	0	25	22	21
Primary metals	33	53	11	20	92	2	5	35	11	18
Ferrous metals and products	331-32,3398-99	69	12	13	99	([1])	([1])	49	6	30
Nonferrous metals and products	333-36	49	25	23	33	62	5	45	14	28
Fabricated metal products	34	37	15	19	51	2	42	17	19	16
Machinery	35	58	10	12	87	8	1	24	8	10
Office, computing, and accounting machines	357	77	9	8	97	0	([1])	66	11	14
Other machinery, except electrical	351-56,358-59	38	12	13	77	7	0	14	8	8
Electrical equipment	36	54	15	16	62	16	16	30	19	15
Radio and TV receiving equipment	365	92	3	4	98	2	0	80	9	7
Communication equipment	366	75	14	8	64	24	12	69	14	10
Electronic components	367	60	18	13	84	7	8	49	11	21
Other electrical equipment	361-64,369	84	5	5	98	([1])	1	51	8	17
Motor vehicles and motor vehicles equipment	371	92	5	7	77	21	2	83	5	7
Other transportation equipment	373-75,379	85	7	6	96	3	([1])	36	26	32
Aircraft and missiles	372,376	52	31	15	54	30	14	35	30	29
Professional and scientific instruments	38	58	18	10	68	20	8	47	14	12
Scientific and mechanical measuring instruments	381-82	71	9	8	86	11	2	54	11	10
Optical, surgical, photographic, and other instruments	383-87	79	9	5	93	0	4	66	10	10
Other manufacturing industries	21,27,31,39	38	17	22	99	0	0	33	5	22
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	29	11	17	43	12	17	5	10	4

Note: All rankings are based on total R&D funds.

[1] Less than 0.5 percent.

SOURCE: National Science Foundation.

Table B-27. Funds for basic research, applied research, and development performance: 1953-83

[Dollars in millions]

Year	Total	Basic research	Applied research	Development
1953	$3,630	$151	[1] $726	[1] $2,753
1954	4,070	166	[1] 814	[1] 3,090
1955	4,640	189	[1] 928	[1] 3,523
1956	6,605	253	1,268	5,084
1957	7,731	271	1,670	5,790
1958	8,389	295	1,911	6,183
1959	9,618	320	1,991	7,307
1960	10,509	376	2,029	8,104
1961	10,908	395	1,977	8,537
1962	11,464	488	2,449	8,527
1963	12,630	522	2,457	9,651
1964	13,512	549	2,600	10,362
1965	14,185	592	2,658	10,934
1966	15,548	624	2,843	12,081
1967	16,385	629	2,915	12,842
1968	17,429	642	3,124	13,663
1969	18,308	618	3,287	14,403
1970	18,067	602	3,427	14,038
1971	18,320	590	3,415	14,315
1972	19,552	593	3,514	15,445
1973	21,249	631	3,825	16,793
1974	22,887	699	4,288	17,900
1975	24,187	730	4,570	18,887
1976	26,997	819	5,112	21,066
1977	29,825	911	5,636	23,278
1978	33,304	[2] 1,035	[2] 6,300	[2] 25,969
1979	38,226	[2] 1,158	[2] 7,225	[2] 29,843
1980	44,505	[2] 1,325	[2] 8,450	[2] 34,730
1981	51,810	[2] 1,614	[2] 10,699	[2] 39,497
1982	57,996	[2] 1,880	[2] 12,175	[2] 43,940
1983	62,816	2,104	13,405	47,306

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[1] Estimated by the National Science Foundation.

[2] National Science Foundation, *National Patterns of Science and Technology Resources*, 1985 (Washington, DC.: Supt. of Documents, U.S. Govenment Printing Office 1985).

SOURCE: National Science Foundation.

Table B-28. Funds for basic research, applied research, and development by industry and size of company: 1983

[Dollars in millions]

Industry and size of company	SIC code	Total	Basic research	Applied research	Development
Total	....	$62,816	$2,104	$13,405	$47,307
Distribution by industry					
Food and kindred products	20	(1)	54	(1)	475
Textiles and apparel	22,23	(1)	(1)	(1)	(1)
Lumber, wood products, and furniture	24,25	171	(1)	(1)	135
Paper and allied products	26	(1)	(1)	297	322
Chemicals and allied products	28	7,287	(1)	(1)	3,999
Industrial chemicals	281-82,286	3,409	(1)	(1)	1,687
Drugs and medicines	283	(1)	(1)	(1)	(1)
Other chemicals	284-85,287-89	(1)	(1)	(1)	(1)
Petroleum refining and related industries	29	(1)	(1)	(1)	928
Rubber products	30	(1)	(1)	(1)	(1)
Stone, clay, and glass products	32	(1)	(1)	109	359
Primary metals	33	1,096	37	310	749
Ferrous metals and products	331-32,3398-99	(1)	(1)	(1)	(1)
Nonferrous metals and products	333-36	(1)	(1)	149	(1)
Fabricated metal products	34	634	6	194	434
Machinery	35	8,382	165	1,102	7,115
Office, computing, and accounting machines	357	(1)	(1)	(1)	5,180
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	1,935
Electrical equipment	36	13,651	397	2,506	10,748
Radio and TV receiving equipment	365	(1)	(1)	(1)	(1)
Communication equipment	366	6,724	250	1,093	5,381
Electronic components	367	2,016	(1)	(1)	(1)
Other electrical equipment	361-64,369	(1)	(1)	828	3,286
Motor vehicles and motor vehicles equipment	371	5,372	(1)	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	40	91
Aircraft and missiles	372,376	13,741	136	3,427	10,178
Professional and scientific instruments	38	4,387	(1)	722	(1)
Scientific and mechanical measuring instruments	381-82	(1)	(1)	311	(1)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	(1)	(1)	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	2,065	(1)	902	929
Distribution by size of company (based on number of employees)					
Less than 1,000		2,899	187	491	2,221
1,000 to 4,999		4,022	253	1,365	2,404
5,000 to 9,999		2,944	141	912	1,891
10,000 to 24,999		8,585	273	2,760	5,552
25,000 or more		44,366	1,250	7,877	35,239

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[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-29. Funds for basic research, applied research, and development by industry, source of funds, and selected company size-groups: 1983

[Dollars in millions]

Industry and size of company	SIC code	Federal				Company			
		Total	Basic research	Applied research	Development	Total	Basic research	Applied research	Development
Total	....	$20,215	$457	$3,559	$16,199	$42,600	$1,647	$9,846	$31,107
Distribution by industry									
Food and kindred products	20	(1)	0	(1)	(1)	799	54	(1)	(1)
Textiles and apparel	22,23	(1)	0	(1)	(1)	131	(1)	(1)	98
Lumber, wood products, and furniture	24,25	0	0	0	0	171	(1)	(1)	135
Paper and allied products	26	(1)	0	(1)	(1)	681	(1)	(1)	(1)
Chemicals and allied products	28	448	(1)	(1)	201	6,839	536	2,505	3,798
Industrial chemicals	281-82,286	440	(1)	(1)	[illegible]	2,969	303	1,180	1,486
Drugs and medicines	283	(1)	0	(1)	[illegible]	2,931	(1)	(1)	(1)
Other chemicals	284-85,287-89	(1)	0	(1)	0	940	(1)	(1)	611
Petroleum refining and related industries	29	(1)	0	(1)	(1)	2,032	(1)	892	(1)
Rubber products	30	(1)	0	(1)	(1)	746	(1)	(1)	523
Stone, clay, and glass products	32	(1)	(1)	(1)	(1)	448	49	(1)	(1)
Primary metals	33	391	0	11	381	704	37	299	368
Ferrous metals and products	331-32,3398-99	(1)	0	(1)	(1)	420	(1)	(1)	236
Nonferrous metals and products	333-36	(1)	0	(1)	(1)	284	(1)	(1)	132
Fabricated metal products	34	66	0	12	54	568	6	182	380
Machinery	35	1,144	19	348	777	7,238	146	754	6,338
Office, computing, and accounting machines	357	(1)	(1)	(1)	652	5,116	(1)	(1)	4,528
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	125	2,122	(1)	(1)	1,810
Electrical equipment	36	5,081	68	537	4,476	8,570	329	1,969	6,272
Radio and TV receiving equipment	365	(1)	0	(1)	(1)	388	(1)	(1)	(1)
Communication equipment	366	2,367	(1)	(1)	2,138	4,357	(1)	(1)	3,246
Electronic components	367	346	0	(1)	(1)	1,670	(1)	507	(1)
Other electrical equipment	361-64,369	(1)	(1)	(1)	1,742	2,155	(1)	(1)	1,544
Motor vehicles and motor vehicles equipment	371	566	(1)	(1)	(1)	4,806	(1)	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	(1)	(1)	106	(1)	(1)	(1)
Aircraft and missiles	372,376	10,300	(1)	(1)	7,621	3,441	(1)	(1)	2,557
Professional and scientific instruments	38	640	(1)	(1)	(1)	3,748	(1)	(1)	2,825
Scientific and mechanical measuring instruments	381-82	(1)	0	(1)	(1)	1,699	(1)	(1)	1,346
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	(1)	(1)	2,048	(1)	(1)	1,479
Other manufacturing industries	21,27,31,39	(1)	0	(1)	(1)	556	(1)	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	1,048	(1)	565	(1)	1,017	(1)	337	(1)
Distribution by size of company (based on number of employees)									
5,000 to 9,999		529	18	127	384	2,415	123	785	1,507
10,000 to 24,999		1,597	43	354	1,201	6,988	230	2,406	4,351
25,000 or more		16,791	186	2,644	13,961	27,575	1,064	5,233	21,278

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-30. Funds for basic research by industry and size of company: 1957-58, 1963, 1967, 1972-77, 1979, 1981, and 1983

[Dollars in millions]

Industry and size of company	SIC code	[1]1957	[1]1958	1963	1967	1972	1973	1974	1975	1976	1977	1979	1981	1983
Total..................................	....	$271	$295	$522	$629	$593	$631	$699	$730	$819	$911	$1,158	$1,614	$2,104
Distribution by industry														
Food and kindred products..................	20	4	5	12	17	13	11	9	10	18	20	17	27	54
Textiles and apparel.......................	22,23	1	1	1	2	2	1	2	(2)	(2)	(2)	(2)	1	(2)
Lumber, wood products, and furniture.......	24,25	0	0	0	0	(2)	(2)	(2)	3	5	7	5	(2)	(2)
Paper and allied products..................	26	1	(2)	2	4	4	5	7	5	6	9	18	32	(2)
Chemicals and allied products..............	28	82	92	152	184	214	236	288	294	304	337	366	539	(2)
Industrial chemicals......................	281-82,286	(2)	(2)	105	(2)	117	125	157	154	154	163	197	335	(2)
Drugs and medicines.......................	283	18	21	33	45	78	90	107	112	119	134	143	(2)	(2)
Other chemicals...........................	284-85,287-89	6	6	14	14	19	21	24	27	32	40	(2)	24	(2)
Petroleum refining and related industries..	29	35	34	34	36	22	26	33	36	44	48	74	(2)	(2)
Rubber products............................	30	4	(2)	8	5	6	3	5	4	7	9	18	23	(2)
Stone, clay, and glass products............	32	(3)	(3)	6	(2)	18	20	21	32	38	41	40	(2)	(2)
Primary metals.............................	33	6	7	11	13	9	8	9	14	16	14	24	46	37
Ferrous metals and products[4]..............	331-32,3398-99	5	5	8	(2)	(2)	(2)	(2)	4	5	5	12	(2)	(2)
Nonferrous metals and products[4]..........	333-36	(2)	2	3	4	(2)	(2)	(2)	10	12	9	12	16	(2)
Fabricated metal products..................	34	1	1	5	3	7	11	3	5	2	2	4	8	6
Machinery..................................	35	17	20	25	26	24	24	28	32	56	57	66	128	165
Office, computing, and accounting machines...............................	357	(5)	(5)	(5)	(5)	(2)	(2)	(2)	26	38	41	51	(2)	(2)
Other machinery, except electrical.......	351-56,358-59	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	18	16	15	(2)	(2)
Electrical equipment.......................	36	53	63	133	131	137	143	143	132	163	181	228	279	397
Radio and TV receiving equipment.........	365	(7)	(7)	(7)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Communication equipment..................	366	36	43	110	112	108	117	116	109	130	150	195	(2)	250
Electronic components....................	367					10	8	5	4	5	6	7	(2)	(2)
Other electrical equipment...............	361-64,369	17	21	23	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Motor vehicles and motor vehicles equipment	371	5	(2)	28	(2)	10	8	9	10	8	12	(2)	(2)	(2)
Other transportation equipment............	373-75,379					(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Aircraft and missiles......................	372,376	25	26	59	73	62	58	57	54	54	55	88	128	136
Professional and scientific instruments....	38	8	10	(2)	(2)	17	15	16	16	23	24	(2)	40	(2)
Scientific and mechanical measuring instruments.............................	381-82	3	2	1	(2)	6	5	5	9	10	12	(2)	(2)	(2)
Optical, surgical, photographic, and other instruments.......................	383-87	6	8	(2)	(2)	11	10	11	8	12	12	(2)	(2)	(2)
Other manufacturing industries.............	21,27,31,39	13	8	3	5	5	6	6	(2)	(2)	(2)	42	21	(2)
Nonmanufacturing industries................	07-17,41-67,737, 739,807,891	(2)	(2)	28	52	28	28	26	25	29	44	57	(2)	(2)
Distribution by size of company (based on number of employees)														
Less than 1,000............................	....	(2)	(2)	(2)	56	36	32	34	57	68	75	98	153	187
1,000 to 4,999.............................	....	24	32	31	45	45	58	47	34	52	54	69	179	253
5,000 to 9,999.............................	....	218	240	439	50	58	75	88	103	118	125	158	118	141
10,000 to 24,999...........................	....				478	90	98	102	96	138	168	211	229	273
25,000 or more.............................	....					364	368	428	440	443	489	622	935	1,250

[1] Estimated by the National Science Foundation.
[2] Not separately available but included in total. See general notes.
[3] Data included in the other manufacturing industries group.
[4] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-65.
[5] Data not tabulated at this level prior to 1972.
[6] Data not tabulated at this level prior to 1975.
[7] Included in the other electrical equipment group.

SOURCE: National Science Foundation.

Table B-31. Funds for basic research by field of science and engineering: 1967, 1972-77, 1979, 1981, and 1983

[Dollars in millions]

Field of science and engineering	1967	1972	1973	1974	1975	1976	1977	1979	1981	1983
Total	$629	$593	$631	$699	$730	$819	$911	$1,158	$1,614	$2,104
Physical sciences	308	277	276	319	320	360	405	527	746	902
Chemistry	162	183	193	229	228	253	285	381	485	555
Physics	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Astronomy	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Mathematics	12	12	14	13	14	18	19	20	26	27
Environmental sciences	14	6	7	10	15	17	19	13	18	29
Atmospheric sciences	(1)	(1)	2	3	6	6	5	5	12	16
Geological sciences	(1)	4	3	5	5	7	7	6	6	13
Oceanography	(1)	(1)	1	1	3	4	7	2	0	0
Engineering (including metallurgy)	172	183	185	178	191	204	233	292	458	682
Life sciences	69	82	102	119	122	134	156	177	208	276
Biological sciences	(1)	61	77	83	85	102	128	136	157	241
Clinical medical sciences	(1)	21	25	36	37	32	28	40	51	35
Other sciences	53	33	47	60	67	85	78	128	158	188

Note: Data not collected for 1978, 1980, and 1982.

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-32. Funds for basic research by industry and field of science and engineering: 1983

[Dollars in millions]

Industry	SIC code	Total	Physical sciences	Mathematics	Environmental sciences	Engineering (including metallurgy)	Life sciences	Other sciences
Total	....	$2,104	$902	$27	$29	$682	$276	188
Food and kindred products	20	54	18	(1)	0	(1)	21	7
Textiles and apparel	22,23	(1)	(1)	0	0	0	0	0
Lumber, wood products, and furniture	24,25	(1)	0	0	0	(1)	0	(1)
Paper and allied products	26	(1)	24	0	0	(1)	(1)	7
Chemicals and allied products	28	(1)	349	(1)	(1)	30	223	(1)
Industrial chemicals	281-82,286	(1)	186	(1)	(1)	20	156	7
Drugs and medicines	283	(1)	(1)	0	0	(1)	63	(1)
Other chemicals	284-85,287-89	(1)	(1)	0	0	(1)	5	(1)
Petroleum refining and related industries	29	(1)	(1)	0	(1)	(1)	17	0
Rubber products	30	(1)	(1)	0	0	(1)	0	0
Stone, clay, and glass products	32	(1)	40	0	11	(1)	0	2
Primary metals	33	37	(1)	0	0	(1)	0	(1)
Ferrous metals and products	331-32,3398-99	(1)	(1)	0	0	(1)	0	8
Nonferrous metals and products	333-36	(1)	(1)	0	0	12	0	(1)
Fabricated metal products	34	6	(1)	0	0	(1)	0	0
Machinery	35	165	120	(1)	0	(1)	0	27
Office, computing, and accounting machines	357	(1)	(1)	(1)	0	(1)	0	8
Other machinery, except electrical	351-56,358-59	(1)	(1)	0	0	(1)	0	19
Electrical equipment	36	397	100	14	0	193	(1)	(1)
Radio and TV receiving equipment	365	(1)	0	0	0	(1)	0	0
Communication equipment	366	250	74	14	0	(1)	0	(1)
Electronic components	367	(1)	15	0	0	26	0	(1)
Other electrical equipment	361-64,369	(1)	(1)	[illegible]	0	36	(1)	0
Motor vehicles and motor vehicles equipment	371	(1)	5	0	(1)	10	0	(1)
Other transportation equipment	373-75,379	(1)	(1)	0	0	5	(1)	0
Aircraft and missiles	372,376	136	(1)	0	0	112	0	(1)
Professional and scientific instruments	38	(1)	(1)	0	0	18	(1)	0
Scientific and mechanical measuring instruments	381-82	(1)	0	0	0	(1)	(1)	0
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	0	0	(1)	(1)	0
Other manufacturing industries	21,27,31,39	(1)	(1)	0	0	0	0	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	124	0	(1)	95	(1)	6

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-33. R&D-performing companies with 1,000 or more employees conducting basic research by industry: 1983

Industry and size of company	SIC code	Companies with total employment of--									
		1,000 or more		1,000 to 4,999		5,000 to 9,999		10,000 to 24,999		25,000 or more	
		R&D	Basic research	R&D	Basic research	R&D	Basic research	R&D	Basic research	R&D	Basic research
Total	....	1,319	165	807	56	199	23	190	48	123	38
Food and kindred products	20	105	17	51	4	22	5	23	5	9	3
Textiles and apparel	22,23	63	4	37	1	13	2	10	1	3	0
Lumber, wood products, and furniture	24,25	46	3	33	2	9	0	2	1	2	0
Paper and allied products	26	53	6	29	2	8	0	12	3	4	1
Chemicals and allied products	28	109	34	60	14	15	7	24	8	10	5
Industrial chemicals	281-82,286	32	16	13	6	7	5	6	1	6	4
Drugs and medicines	283	32	11	14	4	3	1	12	5	3	1
Other chemicals	284-85,287-89	45	7	33	4	5	1	6	2	1	0
Petroleum refining and related industries	29	24	10	7	1	2	0	5	3	10	6
Rubber products	30	38	4	28	0	3	1	5	2	2	1
Stone, clay, and glass products	32	37	7	20	1	7	1	8	4	2	1
Primary metals	33	75	12	48	2	9	2	11	4	7	4
Ferrous metals and products	331-32,3398-99	51	6	32	1	7	1	6	1	6	3
Nonferrous metals and products	333-36	24	6	16	1	2	1	5	3	1	1
Fabricated metal products	34	74	5	55	2	11	0	4	1	4	2
Machinery	35	164	13	114	9	21	0	18	3	11	1
Office, computing, and accounting machines	357	41	3	27	2	3	0	5	0	6	1
Other machinery, except electrical	351-56,358-59	123	10	87	7	18	0	13	3	5	0
Electrical equipment	36	143	15	92	5	17	1	19	5	15	4
Radio and TV receiving equipment	365	13	2	8	1	1	0	2	1	2	0
Communication equipment	366	30	3	17	0	3	0	5	2	5	1
Electronic components	367	33	3	22	0	3	0	4	1	4	2
Other electrical equipment	361-64,369	67	7	45	4	10	1	8	1	4	1
Motor vehicles and motor vehicles equipment	371	36	3	20	0	6	0	5	1	5	2
Other transportation equipment	373-75,379	18	2	13	0	2	1	1	0	2	1
Aircraft and missiles	372,376	33	10	12	2	4	0	5	2	12	6
Professional and scientific instruments	38	57	5	38	3	9	2	5	0	5	0
Scientific and mechanical measuring instruments	381-82	30	3	22	2	4	1	2	0	2	0
Optical, surgical, photographic, and other instruments	383-87	27	2	16	1	5	1	3	0	3	0
Other manufacturing industries	21,27,31,39	78	6	50	3	11	0	10	2	7	1
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	166	9	100	5	30	1	23	3	13	0

[1] Data not available for companies with less than 1,000 employees.

SOURCE: National Science Foundation.

Table B-34. Funds for applied research and development by product field: 1963-64, 1967-77, 1979, 1981, and 1983

[Dollars in millions]

Product field	SIC code	1963	1964	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1979	1981	1983
Total	....	$12,108	$12,962	$15,757	$16,787	$17,690	$17,465	$17,730	$18,959	$20,618	$22,188	$23,457	$26,178	$28,914	$37,068	$50,196	$60,712
Atomic energy devices[1]	--	609	709	675	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Food and kindred products	20	102	118	134	165	179	206	211	227	243	283	273	308	348	420	492	636
Textile mill products	22	(2)	(2)	55	58	66	55	60	83	93	82	73	81	96	(2)	(2)	(2)
Chemicals, except drugs and medicines	28, except 283	861	949	1,119	1,168	1,214	1,339	1,345	1,250	1,342	1,564	1,627	1,853	2,018	2,501	3,267	4,033
Industrial inorganic and organic chemicals	281,286	242	304	347	396	417	442	457	451	489	589	665	728	819	(2)	1,020	1,146
Plastics materials and synthetic resins, rubber, and fibers	282	379	402	474	466	482	521	511	453	511	589	588	674	744	881	1,060	1,360
Agricultural chemicals	287	45	48	92	99	104	126	130	108	114	137	176	205	236	292	487	587
Other chemicals	284-85,289	196	195	205	207	210	223	218	238	229	248	198	246	220	(2)	700	940
Drugs and medicines	283	227	234	346	375	417	474	535	531	605	683	783	883	955	1,089	1,837	2,601
Petroleum refining and related industries	29	194	205	215	239	252	272	266	299	319	363	408	425	471	650	975	929
Rubber and miscellaneous plastics products	30	87	102	132	160	163	193	215	279	294	341	324	325	376	407	(2)	(2)
Stone, clay, and glass products	32	74	85	121	130	157	128	128	135	162	181	150	171	191	235	240	194
Primary metals	33	152	164	208	207	224	235	230	245	272	311	290	311	327	438	684	558
Ferrous metals and products	331-32 3398-99	90	97	117	119	125	127	114	137	158	156	144	163	172	225	268	278
Nonferrous metals and products	333-36	62	68	91	88	99	108	116	108	114	155	147	148	155	213	416	280
Fabricated metal products	34, except 348	135	150	204	478	504	622	701	731	769	903	916	1,025	1,152	1,381	1,518	1,379
Ordnance and accessories, n.e.c	348	92	94	218	201	186	192	192	177	228	222	187	199	288	316	453	(2)
Machinery	35	913	970	1,293	1,396	1,562	1,676	1,783	1,989	2,307	2,689	2,628	3,001	3,554	4,561	6,288	7,452
Engines and turbines	351	124	126	192	203	196	204	246	316	360	482	464	477	528	589	904	1,199
Farm machinery and equipment	352	76	79	102	96	99	89	90	93	120	131	138	168	221	295	278	290
Construction, mining and materials handling machinery	353	58	60	119	129	154	182	196	206	265	283	285	317	376	632	569	506
Metalworking machinery and equipment	354	58	66	67	90	83	86	84	76	69	74	80	83	125	340	227	244
Office, computing, and accounting machines	357	412	458	614	678	812	863	903	1,028	1,219	1,422	1,339	1,580	1,849	1,961	3,220	4,091
Other machinery, except electrical	355-56,358-59	185	182	199	201	218	252	264	270	274	297	322	376	455	744	1,090	1,122
Electrical equipment, except radio and TV receiving equipment, communication equipment, and electronic components	36, except 365-67;3825	277	305					688	775	857	929	774	874	901	980	1,724	1,874
Electric transmission and distribution equipment	361,3825	47	46					181	189	204	239	205	224	224	191	(2)	(2)
Electrical industrial apparatus	362	77	84	3,053	3,363	3,409	3,372	187	231	263	264	260	306	298	291	(2)	(2)
Other electrical equipment and supplies	363-64,368-69	152	175					320	355	390	426	309	344	379	498	653	1,003
Radio and TV receiving equipment, communication equipment, and electronic components	365-67	2,150	2,223					2,927	3,234	3,621	3,896	3,911	4,483	5,019	6,696	(2)	(2)
Motor vehicles and other transportation equipment	37, except 372,376	651	678	831	956	1,139	1,138	1,341	1,668	2,014	1,994	1,924	2,263	(2)	(2)	(2)	(2)
Motor vehicles and equipment	371	623	651	755	860	1,051	1,046	1,228	1,470	1,824	1,784	1,720	(2)	(2)	(2)	(2)	(2)
Other transportation equipment	373-75,379	28	27	76	96	88	90	113	198	190	210	204	193	201	205	(2)	377
Aircraft and parts	372	[3]1,520	[3]1,670	2,165	2,370	2,579	2,556	2,486	2,396	2,548	2,420	2,265	2,733	3,113	3,460	4,924	5,877
Guided missiles and spacecraft	376	3,345	3,496	3,741	3,786	3,711	3,115	2,832	2,647	2,491	2,486	2,925	2,880	3,024	4,465	4,814	6,904
Professional and scientific instruments	38, except 3825	298	346	535	719	814	724	652	847	981	1,090	1,002	1,140	1,255	1,434	1,486	1,812
Other product fields, n.e.c	--	[3]421	[3]463	710	1,013	1,124	1,194	1,177	1,440	1,465	1,742	2,987	3,179	3,201	4,062	5,657	6,681

N.e.c. Not elsewhere classified.

[1] Distributed according to SIC code from 1968 to present.
[2] Not separately available but included in total. See general notes.
[3] Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table B-35. Funds for applied research and development by product field and source of funds: 1983

[Dollars in millions]

Product field	SIC code	Total	Federal	Company
Total	....	$60,712	$19,758	$40,953
Food and kindred products	20	636	(1)	(1)
Textiles mill products	22	(1)	(1)	(1)
Chemicals, except drugs and medicines	28, except 283	4,033	(1)	3,984
Industrial inorganic and organic chemicals	281,286	1,146	33	1,113
Plastics materials and synthetic resins, rubber and fibers	282	1,360	(1)	1,354
Agricultural chemicals	287	587	0	587
Other chemicals	284-85,289	940	(1)	930
Drugs and medicines	283	2,601	(1)	(1)
Petroleum refining and related industries	29	929	6	923
Rubber and miscellaneous plastics products	30	(1)	(1)	(1)
Stone, clay, and glass products	32	194	(1)	(1)
Primary metals	33	558	68	490
Ferrous metals and products	331-32,3398-99	278	5	273
Nonferrous metals and products	333-36	280	63	217
Fabricated metal products	34, except 348	1,379	589	790
Ordnance and accessories, n.e.c	348	(1)	(1)	(1)
Machinery	35	7,452	455	6,997
Engines and turbines	351	1,199	168	1,031
Farm machinery and equipment	352	290	0	290
Construction, mining, and materials handling machinery	353	506	(1)	(1)
Metalworking machinery equipment	354	244	(1)	(1)
Office, computing, and accounting machines	357	4,091	(1)	3,905
Other machinery, except electrical	356,358-59	1,122	(1)	(1)
Electrical equipment except radio and TV receiving equipment, communication equipment, and electronic components	36, except 365-67; 3825	1,874	(1)	(1)
Electric transmission and distribution equipment	361,3825	(1)	(1)	(1)
Electrical industrial apparatus	362	(1)	(1)	(1)
Other electrical equipment and supplies	363-64,368-69	1,003	248	755
Radio and TV receiving equipment, communication equipment, and electronic components	365-67	(1)	(1)	(1)
Motor vehicles and other transportation equipment	37, except 371,376	(1)	(1)	(1)
Motor vehicles and equipment	371	(1)	(1)	(1)
Other transportation equipment	373-75,379	377	(1)	(1)
Aircraft and parts	372	5,877	2,926	2,951
Guided missiles and spacecraft	376	6,904	6,467	437
Professional and scientific instruments	38, except 3825	1,812	(1)	(1)
Other product fields, not elsewhere classified	-	6,681	2,718	3,963

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-36. Funds for applied research and development by industry and product field: 1983

[Dollars in millions]

Industry	SIC code	Total	Food and kindred products 20	Textile mill products 22	Chemicals, except drugs and medicines 28, except 283	Drugs and medicines 283	Petroleum refining 29	Rubber products 30	Stone, clay, and glass products 32	Primary metals 33	Fabricated metal products 34, except 348
Total..................................	....	$60,712	$636	(1)	$4,033	$2,601	$929	(1)	$194	$558	$1,379
Food and kindred products....................	20	(1)	322	(1)	27	(1)	0	(1)	(1)	(1)	7
Textiles and apparel.........................	22,23	(1)	0	87	(1)	0	(1)	(1)	0	0	(1)
Lumber, wood products, and furniture........	24,25	(1)	(1)	0	(1)	0	0	(1)	(1)	0	10
Paper and allied products....................	26	619	(1)	(1)	31	0	0	(1)	0	0	(1)
Chemicals and allied products...............	28	(1)	264	122	2,536	2,207	47	(1)	27	(1)	144
Industrial chemicals......................	281-82,286	(1)	(1)	104	1,746	307	(1)	(1)	(1)	(1)	138
Drugs and medicines.......................	283	(1)	(1)	(1)	250	1,817	0	(1)	(1)	(1)	4
Other chemicals...........................	284-85,287-89	(1)	103	(1)	540	83	(1)	0	(1)	0	2
Petroleum refining and related industries...	29	(1)	(1)	0	531	(1)	748	(1)	(1)	31	70
Rubber products..............................	30	(1)	11	(1)	(1)	(1)	0	146	(1)	(1)	(1)
Stone, clay, and glass products.............	32	468	0	0	73	(1)	0	4	123	(1)	(1)
Primary metals...............................	33	1,059	(1)	0	81	(1)	63	(1)	4	271	50
Ferrous metals and products...............	331-32,3398-99	(1)	0	0	27	(1)	(1)	(1)	(1)	163	27
Nonferrous metals and products............	333-36	(1)	(1)	0	54	(1)	(1)	0	(1)	107	23
Fabricated metal products...................	34	628	(1)	(1)	101	0	(1)	0	(1)	11	161
Machinery....................................	35	8,218	(1)	(1)	(1)	(1)	59	29	(1)	32	77
Office, computing, and accounting machines	357	(1)	(1)	0	0	0	0	0	0	(1)	(1)
Other machinery, except electrical........	351-56,358-59	(1)	(1)	(1)	(1)	(1)	59	29	(1)	(1)	(1)
Electrical equipment.........................	36	13,254	21	0	215	4	(1)	6	9	21	646
Radio and TV receiving equipment..........	365	(1)	0	0	(1)	0	0	0	0	0	0
Communication equipment...................	366	6,474	0	0	(1)	(1)	(1)	(1)	0	3	0
Electronic components.....................	367	(1)	(1)	0	67	0	0	(1)	(1)	0	(1)
Other electrical equipment................	361-64,369	4,114	(1)	0	139	(1)	(1)	(1)	(1)	18	(1)
Motor vehicles and motor vehicles equipment.	371	(1)	0	0	126	0	0	23	(1)	23	125
Other transportation equipment..............	373-75,379	131	(1)	0	(1)	(1)	0	(1)	0	(1)	(1)
Aircraft and missiles........................	372,376	13,605	(1)	0	44	4	2	(1)	(1)	122	49
Professional and scientific instruments.....	38	(1)	(1)	3	36	(1)	(1)	(1)	0	0	(1)
Scientific and mechanical measuring instruments..............................	381-82	(1)	0	0	(1)	0	(1)	(1)	0	0	(1)
Optical, surgical, photographic, and other instruments..............................	383-87	(1)	(1)	3	(1)	(1)	0	(1)	0	0	(1)
Other manufacturing industries..............	21,27,31,39	(1)	(1)	(1)	21	0	(1)	(1)	(1)	(1)	19
Nonmanufacturing industries.................	07-17,41-67,737, 739,807,891	1,831	(1)	0	78	0	(1)	(1)	9	29	(1)

See footnote at end of table.

Table B-3b. Funds for applied research and development by industry and product field: 1983--Continued

[Dollars in millions]

Industry	SIC code	Ordnance and accessories, n.e.c. 348	Machinery 35	Electrical equipment 36,except 365-67; 3825	Radio and TV receiving equipment, communication equipment, and electronic components 365-67	Motor vehicles and other transportation equipment 37,except 372,376	Aircraft and parts 372	Guided missiles and spacecraft 376	Professional and scientific instruments 38, except 3825	Other product fields, n.e.c. ....
Total	....	(1)	$7,452	$1,874	(1)	(1)	$5,877	$6,904	$1,812	$6,851
Food and kindred products	20	0	19	(1)	(1)	0	0	0	0	75
Textiles and apparel	22,23	0	(1)	0	2	2	0	(1)	(1)	(1)
Lumber, wood products, and furniture	24,25	0	18	0	(1)	0	0	0	0	(1)
Paper and allied products	26	0	21	(1)	10	(1)	0	0	(1)	(1)
Chemicals and allied products	28	(1)	29	16	63	(1)	0	(1)	230	336
Industrial chemicals	281-82,286	(1)	27	13	52	(1)	0	(1)	90	199
Drugs and medicines	283	0	(1)	(1)	(1)	0	0	0	(1)	(1)
Other chemicals	284-85,287-89	(1)	(1)	(1)	(1)	0	0	0	(1)	(1)
Petroleum refining and related industries	29	0	13	11	47	(1)	0	0	(1)	354
Rubber products	30	(1)	(1)	17	91	0	(1)	(1)	(1)	(1)
Stone, clay, and glass products	32	0	3	(1)	(1)	19	(1)	46	16	45
Primary metals	33	2	34	8	41	29	11	(1)	(1)	68
Ferrous metals and products	331-32,3398-99	(1)	19	(1)	(1)	18	(1)	(1)	0	42
Nonferrous metals and products	333-36	(1)	15	(1)	(1)	11	(1)	(1)	(1)	26
Fabricated metal products	34	16	13	(1)	12	(1)	(1)	0	21	107
Machinery	35	(1)	4,824	274	1,646	85	(1)	(1)	52	856
Office, computing, and accounting machines	357	0	3,550	(1)	(1)	0	0	0	(1)	685
Other machinery, except electrical	351-56,358-59	(1)	1,274	(1)	(1)	85	(1)	(1)	(1)	171
Electrical equipment	36	77	776	1,099	6,879	75	950	718	139	1,613
Radio and TV receiving equipment	365	0	0	80	520	(1)	0	(1)	0	(1)
Communication equipment	366	23	(1)	583	3,756	27	0	0	4	1,198
Electronic components	367	0	(1)	204	1,392	(1)	(1)	(1)	(1)	(1)
Other electrical equipment	361-64,369	54	302	232	1,211	41	(1)	564	(1)	319
Motor vehicles and motor vehicles equipment	371	(1)	578	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	7	59	(1)	(1)	0	0	(1)
Aircraft and missiles	372,376	67	354	(1)	(1)	246	4,749	5,319	11	279
Professional and scientific instruments	38	(1)	(1)	(1)	(1)	(1)	26	(1)	(1)	1,218
Scientific and mechanical measuring instruments	381-82	(1)	(1)	(1)	(1)	(1)	(1)	0	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	(1)	47	6	26	21	(1)	(1)	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	14	92	(1)	(1)	(1)	69	82	19	(1)

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[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-37. Funds for applied research and development by industry and secondary product field: 1983

[Dollars in millions]

Industry	SIC code	Chemicals, except drugs and medicines				Primary metals		Machinery	
		Industrial inorganic and organic chemicals 281,286	Plastics; synthetic resins, rubber, and fibers 282	Agricultural chemicals 287	Other chemicals 284-85, 289	Ferrous metals and products 331-32, 3398-99	Nonferrous metals and products 333-36	Engines and turbines 351	Farm machinery and equipment 352
Total	....	$1,146	$1,360	$587	$940	$278	$280	$1,199	$290
Food and kindred products	20	(1)	8	(1)	12	0	(1)	0	(1)
Textiles and apparel	22,23	(1)	8	0	(1)	0	0	0	0
Lumber, wood products, and furniture	24,25	0	3	(1)	(1)	0	0	0	0
Paper and allied products	26	(1)	8	(1)	(1)	0	0	0	0
Chemicals and allied products	28	714	779	448	595	26	(1)	(1)	0
Industrial chemicals	281-82,286	549	754	258	185	26	(1)	0	0
Drugs and medicines	283	53	(1)	(1)	31	0	(1)	0	0
Other chemicals	284-85,287-89	112	(1)	(1)	379	0	0	(1)	0
Petroleum refining and related industries	29	160	196	82	93	0	31	(1)	0
Rubber products	30	(1)	22	(1)	(1)	0	(1)	0	0
Stone, clay, and glass products	32	15	13	26	19	(1)	(1)	0	0
Primary metals	33	37	8	0	36	161	110	(1)	0
Ferrous metals and products	331-32,3398-99	7	(1)	0	(1)	159	4	(1)	0
Nonferrous metals and products	333-36	30	(1)	0	(1)	1	106	0	0
Fabricated metal products	34	35	47	(1)	(1)	3	8	0	0
Machinery	35	(1)	(1)	(1)	(1)	3	29	405	265
Office, computing, and accounting machines	357	0	0	0	0	(1)	0	0	23
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	(1)	(1)	29	405	242
Electrical equipment	36	67	99	(1)	(1)	9	12	116	(1)
Radio and TV receiving equipment	365	0	(1)	0	0	0	0	0	0
Communication equipment	366	(1)	0	0	(1)	0	3	(1)	0
Electronic components	367	41	(1)	0	(1)	0	0	0	0
Other electrical equipment	361-64,369	(1)	88	(1)	(1)	9	9	(1)	(1)
Motor vehicles and motor vehicles equipment	371	(1)	96	0	(1)	16	6	505	5
Other transportation equipment	373-75,379	(1)	(1)	(1)	(1)	(1)	0	(1)	0
Aircraft and missiles	372,376	7	19	3	15	(1)	(1)	113	18
Professional and scientific instruments	38	(1)	22	(1)	9	0	0	(1)	0
Scientific and mechanical measuring instruments	381-82	0	(1)	0	(1)	0	0	(1)	0
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	(1)	(1)	0	0	0	0
Other manufacturing industries	21,27,31,39	(1)	17	(1)	(1)	0	(1)	0	0
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	(1)	(1)	31	8	21	(1)	(1)

See footnote at end of table.

Table B-37. Funds for applied research and development by industry and secondary product field: 1983--Continued

[Dollars in millions]

Industry	SIC code	Machinery--Continued				Electrical equipment, except radio and TV receiving equipment, communication equipment, and electronic components			Motor vehicles and other transportation equipment	
		Construction, mining, and materials handling machinery 353	Metal-working machinery and equipment 354	Office, computing and accounting machines 357	Other machinery, except electrical 355-56, 358-59	Electric transmission and distribution equipment 361,3825	Electrical industrial apparatus 362	Other electrical equipment and supplies 363-64, 368-69	Motor vehicles and equipment 371	Other transportation equipment 379
Total	....	$506	$244	$4,091	$1,122	(1)	(1)	$1,003	(1)	$377
Food and kindred products	20	(1)	(1)	0	16	0	(1)	(1)	0	0
Textiles and apparel	22,23	(1)	(1)	(1)	(1)	0	0	0	(1)	(1)
Lumber, wood products, and furniture	24,25	(1)	0	0	(1)	0	0	0	0	0
Paper and allied products	26	(1)	0	(1)	19	0	(1)	(1)	(1)	0
Chemicals and allied products	28	0	(1)	0	22	(1)	13	(1)	(1)	(1)
Industrial chemicals	281-82,286	0	(1)	0	(1)	(1)	(1)	(1)	(1)	(1)
Drugs and medicines	283	0	(1)	0	(1)	(1)	(1)	(1)	0	0
Other chemicals	284-85,287-89	0	0	0	0	0	0	(1)	0	0
Petroleum refining and related industries	29	2	2	(1)	(1)	0	5	6	0	(1)
Rubber products	30	(1)	0	(1)	0	(1)	0	(1)	0	0
Stone, clay, and glass products	32	(1)	0	0	(1)	0	0	(1)	11	8
Primary metals	33	(1)	16	2	9	7	(1)	(1)	24	5
Ferrous metals and products	331-32,3398-99	(1)	10	2	(1)	(1)	(1)	0	(1)	(1)
Nonferrous metals and products	333-36	(1)	6	0	(1)	(1)	(1)	(1)	(1)	(1)
Fabricated metal products	34	2	3	0	7	0	(1)	(1)	0	(1)
Machinery	35	442	(1)	3,076	(1)	(1)	(1)	230	83	2
Office, computing, and accounting machines	357	0	(1)	(1)	(1)	(1)	(1)	230	0	0
Other machinery, except electrical	351-36,358-59	442	(1)	(1)	(1)	0	(1)	0	83	2
Electrical equipment	36	(1)	47	478	118	(1)	(1)	557	57	18
Radio and TV receiving equipment	365	0	0	0	0	(1)	0	(1)	(1)	0
Communication equipment	366	0	(1)	238	59	(1)	(1)	468	(1)	(1)
Electronic components	367	0	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Other electrical equipment	361-64,369	(1)	(1)	(1)	(1)	(1)	(1)	(1)	28	13
Motor vehicles and motor vehicles equipment	371	11	(1)	(1)	36	9	13	(1)	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	5	(1)	(1)	(1)	6	(1)	6
Aircraft and missiles	372,376	(1)	[illegible]	(1)	203	72	5	(1)	113	133
Professional and scientific instruments	38	(1)	(1)	(1)	(1)	0	29	(1)	(1)	0
Scientific and mechanical measuring instruments	381-82	(1)	(1)	0	(1)	0	(1)	54	(1)	0
Optical. surgical, photographic, and other instruments	383-87	(1)	0	(1)	0	0	(1)	(1)	(1)	0
Other manufacturing industries	21,27,31,39	(1)	(1)	18	26	(1)	(1)	(1)	0	21
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	(1)	(1)	(1)	(1)	3	(1)	(1)	(1)

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[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table 8-38. Expenditures for energy research and development by selected industry: 1972-84 (projected)

[Dollars in millions]

Industry	SIC code	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984 (projected)
Total	....	$750	$1,009	$1,399	$1,774	$2,073	$2,573	$2,965	$3,643	$4,162	$4,216	$4,287	$4,344	$4,465
Food and kindred products	20	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	4	5	(1)	(1)	(1)
Textiles and apparel	22,23	0	0	0	0	1	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Lumber, wood products, and furniture	24,25	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	3	4	6	6	5
Paper and allied products	26	(1)	(1)	(1)	(1)	(1)	1	2	3	3	2	2	2	2
Chemicals and allied products	28	52	67	71	102	121	148	157	220	257	312	346	363	372
Industrial chemicals	281-82,286	47	65	68	100	(1)	(1)	(1)	(1)	246	305	336	332	360
Drugs and medicines	283	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Other chemicals	284-85,287-89	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Petroleum refining and related industries	29	285	300	374	405	440	536	648	776	865	1,067	1,156	1,257	1,399
Rubber products	30	(1)	(1)	(1)	(1)	(1)	10	12	12	15	17	16	22	29
Stone, clay, and glass products	32	(1)	(1)	(1)	(1)	4	6	7	17	21	24	17	7	8
Primary metals	33	10	17	22	27	33	51	49	72	78	80	100	93	102
Ferrous metals and products	331-32,3398-99	(1)	(1)	(1)	(1)	12	19	16	19	20	20	22	36	38
Nonferrous metals and products	333-36	(1)	(1)	(1)	(1)	21	32	33	48	58	59	78	57	64
Fabricated metal products	34	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	60	43	45
Machinery	35	8	11	16	23	40	61	90	83	108	127	192	176	145
Office, computing, and accounting machines	357	(1)	(1)	(1)	(1)	(1)	(1)	(1)	13	17	6	20	(1)	(1)
Other machinery, except electrical	351-56,358-59	(1)	(1)	(1)	(1)	(1)	(1)	(1)	70	91	121	172	169	122
Electrical equipment	36	196	310	389	466	585	650	716	863	917	908	866	849	800
Radio and TV receiving equipment	365	0	0	0	0	0	0	0	0	3	(1)	5	0	0
Communication equipment	366	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	181	155	154
Electronic components	367	(1)	(1)	(1)	(1)	(1)	5	5	13	12	15	18	17	21
Other electrical equipment	361-64,369	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	661	677	625
Motor vehicles and motor vehicles equipment	371	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Other transportation equipment	373-75,379	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	2	2	2
Aircraft and missiles	372,376	65	111	142	136	180	165	283	372	446	412	366	376	353
Professional and scientific instruments	38	12	13	14	14	30	17	27	28	45	53	75	89	97
Scientific and mechanical measuring instruments	381,82	(1)	(1)	(1)	(1)	(1)	12	19	24	40	(1)	73	(1)	87
Optical, surgical, photographic, and other instruments	385-87	(1)	(1)	(1)	(1)	(1)	5	8	4	5	(1)	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	(1)	(1)	(1)	(1)	(1)	4	7	7	19	(1)	12	17	16
Nonmanufacturing industries	07-17,41-67,737,739,807,891	76	81	100	98	137	185	220	326	333	376	385	356	435

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table 8-39. Company funds for energy research and development by selected industry: 1973-83

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	....	$626	$857	$1,152	$1,319	$1,632	$1,796	$2,230	$2,588	$2,686	$2,798	$2,856
Chemicals and allied products	28	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	169	177	184
Petroleum refining and related industries	29	(1)	(1)	(1)	(1)	469	580	623	699	957	1,091	1,182
Electrical equipment	36	76	96	115	122	165	137	219	205	203	171	180
Aircraft and missiles	372,376	(1)	(1)	(1)	(1)	57	68	113	163	126	88	(1)
All other manufacturing industries	....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1,053	1,102	1,080
Nonmanufacturing industries	07-17,41-67,737,739,807,891	39	68	31	66	75	82	160	156	196	169	166

NOTE: Data not available for 1972.

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table 8-40. Federal funds for energy research and development by selected industry: 1973-83

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	....	$385	$482	$622	$754	$941	$1,169	$1,413	$1,563	$1,536	$1,489	$1,485
Chemicals and allied products	28	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	163	169	179
Petroleum refining and related industries	29	(2)	(2)	(2)	(2)	67	118	153	146	109	66	65
Electrical equipment	36	244	293	349	463	485	577	624	711	705	694	669
Aircraft and missiles	372,376	(2)	(2)	(2)	(2)	108	215	259	283	288	258	(1)
All other manufacturing industries	....	(2)	(2)	(2)	(2)	(2)	(1)	(1)	(1)	91	87	82
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	42	52	67	71	110	139	183	179	180	215	212

NOTE: Data not available for 1972.

[1] Not separately available but included in total. See general notes.
[2] Less than $0.5 million.

SOURCE: National Science Foundation.

Table 8-41. Industrial expenditures for energy research and development by primary energy source: 1972-84 (projected)

[Dollars in millions]

Primary energy source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984 (projected)
Total	$750	$1,009	$1,339	$1,774	$2,073	$2,573	$2,965	$3,643	$4,162	$4,216	$4,287	$4,344	$4,465
Fossil fuels	(1)	438	516	550	605	757	843	1,063	1,228	1,437	1,491	1,583	1,695
Oil	(1)	297	329	333	381	[2]449	(1)	[2]557	(1)	[2]772	(1)	900	1,005
Gas	(1)	51	74	66	68	[2]93	(1)	[2]113	(1)	[2]208	(1)	254	(1)
Shale	(1)	12	18	19	24	[2][illegible]	(1)	[2]24	(1)	[2]57	(1)	48	(1)
Coal	(1)	49	65	109	127	[2]1[illegible]	(1)	[2]313	(1)	[2]383	(1)	(1)	(1)
Synthetic fossil fuels	(1)	(1)	21	50	74	[2]115	(1)	[2]236	(1)	[2]210	(1)	(1)	(1)
Mining	(1)	(1)	5	9	10	[2]9	(1)	[2]1	(1)	[2]31	(1)	(1)	(1)
Other	(1)	(1)	39	50	43	[2]51	(1)	[2]76	(1)	[2]142	(1)	(1)	(1)
Other fossil fuels	(1)	29	30	23	5	[2]5	(1)	[2]36	(1)	[2]17	(1)	(1)	(1)
Nuclear	(1)	501	601	700	799	926	995	1,037	1,056	1,037	1,078	1,086	1,096
Fission	(1)	476	567	659	741	[2]844	(1)	[2]913	(1)	[2]866	(1)	945	944
Fusion	(1)	25	34	41	58	[2]82	(1)	[2]124	(1)	[2]171	(1)	141	152
All other energy	(1)	70	222	524	669	890	1,127	1,543	1,878	1,742	1,718	1,675	1,674
Geothermal	(1)	1	2	6	13	[2]24	(1)	[2]149	(1)	[2]71	(1)	(1)	(1)
Solar	(1)	2	7	19	43	[2]64	(1)	[2]321	(1)	[2]298	(1)	(1)	(1)
Conservation and utilization	(1)	(1)	137	435	528	[2]687	(1)	[2]686	(1)	[2]405	(1)	(1)	(1)
All other sources	(1)	67	76	64	85	[2]115	(1)	[2]387	(1)	[2]968	(1)	(1)	(1)

[1] Data not collected.
[2] Detailed data for 1977, 1979, and 1981 were estimated based upon (a) data actually reported in those years, (b) revised data for those years which were reported on the 1978, 1980, and 1982 survey forms, and (c) adjustments due to new sample in 1981.

SOURCE: National Science Foundation.

Table 8-42. Company funds for energy research and development by primary energy source: 1972-83

[Dollars in millions]

Primary energy source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	(1)	$624	$857	$1,152	$1,316	$1,632	$1,796	$2,230	$2,599	$2,680	$2,798	$2,859
Fossil fuels	(1)	[2]428	[2]503	[2]507	[2]523	644	678	788	993	1,257	1,361	1,465
Oil	(1)	295	[2]326	[2]327	[2]369	[3]436	(1)	[3]529	(1)	[3]746	(1)	(1)
Gas	(1)	(4)	(4)	(4)	52	[3]73	(1)	[3]109	(1)	[3](4)	(1)	(1)
Shale	(1)	[2]12	(4)	(4)	(4)	[3](4)	(1)	[3](4)	(1)	[3](4)	(1)	(1)
Coal	(1)	42	56	77	80	[3]98	(1)	[3]130	(1)	[3]244	(1)	(1)
Synthetic fossil fuels	(1)	(1)	(4)	(4)	48	[3]64	(1)	[3]84	(1)	[3]132	(1)	(1)
Mining	(1)	(1)	(4)	(4)	7	[3]5	(1)	[3]1	(1)	[3]24	(1)	(1)
Other	(1)	(1)	33	34	25	[3]29	(1)	[3]45	(1)	[3]89	(1)	(1)
Other fossil fuels	(1)	(4)	(4)	(4)	(4)	[3](4)	(1)	[3](4)	(1)	[3](4)	(1)	(1)
Nuclear	(1)	135	157	160	198	217	217	169	150	126	99	81
Fission	(1)	127	[2]146	156	194	[3]211	(1)	[3]167	(1)	[3]70	(1)	64
Fusion	(1)	7	11	4	4	[3]6	(1)	[3]2	(1)	[3]56	(1)	17
All other energy	(1)	(4)	(4)	(4)	595	770	901	1,273	1,456	1,297	1,338	1,313
Geothermal	(1)	(4)	(4)	(4)	5	[3]9	(1)	[3]122	(1)	[3]40	(1)	(1)
Solar	(1)	(4)	(4)	(4)	17	[3]22	(1)	[3]251	(1)	[3]199	(1)	(1)
Conservation and utilization	(1)	(1)	[2]129	[2]425	[2]511	[3]656	(1)	[3]681	(1)	[3]334	(1)	(1)
All other sources	(1)	59	62	46	62	[3]83	(1)	[3]219	(1)	[3]724	(1)	(1)

[1] Data not collected.

[2] Revised by the National Science Foundation.

[3] Detailed data for 1977, 1979, and 1981 were estimated based upon (a) data actually reported in those years, (b) revised data for those years which were reported on the 1978, 1980, and 1982 survey forms, and (c) adjustments due to new sample in 1981.

[4] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table 8-43. Federal funds for energy research and development by primary energy source: 1972-83

[Dollars in millions]

Primary energy source	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	(1)	$385	$482	$622	$757	$941	$1,169	$1,413	$1,563	$1,536	$1,489	$1,485
Fossil fuels	(1)	10	13	[2]43	[2]82	113	165	275	235	180	130	118
Oil	(1)	2	3	6	12	[3]11	(1)	[3]29	(1)	[3]26	(1)	(4)
Gas	(1)	(4)	(4)	(4)	16	[3]20	(1)	[3]6	(1)	[3](4)	(1)	10
Shale	(1)	0	(4)	(4)	(4)	[3](4)	(1)	[3](4)	(1)	[3](4)	(1)	1
Coal	(1)	7	9	32	47	[3]77	(1)	[3]183	(1)	[3]139	(1)	77
Synthetic fossil fuels	(1)	(1)	(4)	(4)	26	[3]51	(1)	[3]152	(1)	[3]78	(1)	(4)
Mining	(1)	(1)	(4)	(4)	3	[3]4	(1)	[3]0	(1)	[3]7	(1)	(4)
Other	(1)	(1)	6	16	18	[3]22	(1)	[3]31	(1)	[3]53	(1)	(4)
Other fossil fuels	(1)	(4)	(4)	(4)	(4)	[3](4)	(1)	[3](4)	(1)	[3](4)	(1)	30
Nuclear	(1)	366	444	540	601	709	778	868	906	911	979	1,005
Fission	(1)	349	421	503	547	[3]633	(1)	[3]746	(1)	[3]796	(1)	881
Fusion	(1)	18	23	37	54	[3]76	(1)	[3]122	(1)	[3]115	(1)	124
All other energy	(1)	(4)	(4)	(4)	74	120	226	270	422	445	380	362
Geothermal	(1)	(4)	(4)	(4)	8	[3]15	(1)	[3]27	(1)	[3]31	(1)	(4)
Solar	(1)	(4)	(4)	(4)	26	[3]62	(1)	[3]70	(1)	[3]99	(1)	(4)
Conservation and utilization	(1)	(1)	8	10	17	[3]31	(1)	[3]5	(1)	[3]71	(1)	80
All other sources	(1)	8	14	18	23	[3]12	(1)	[3]168	(1)	[3]244	(1)	(4)

[1] Data not collected.

[2] Revised by the National Science Foundation.

[3] Detailed data for 1977, 1979, and 1981 were estimated based upon (a) data actually reported in those years, (b) revised data for those years which were reported on the 1978, 1980, and 1982 survey forms, and (c) adjustments due to new sample in 1981.

[4] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-44. Expenditures for pollution abatement research and development by industry: 1973-84 (projected)

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984 (projected)
Total	....	$603	$657	$647	$754	$901	$1,065	$1,249	$1,202	(1)	(1)	(1)	(1)
Food and kindred products	20	4	3	3	3	3	2	2	3	1	1	3	(2)
Textiles and apparel	22,23	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Lumber, wood products, and furniture	24,25	3	5	4	4	5	3	3	4	5	4	3	3
Paper and allied products	26	1	4	5	6	6	8	(2)	(2)	(2)	8	5	6
Chemicals and allied products	28	51	61	71	72	82	79	146	178	186	191	181	194
Industrial chemicals	281-82,286	38	39	56	58	64	67	128	157	165	172	158	168
Drugs and medicines	283	(2)	(2)	(2)	(2)	(2)	(2)	4	4	5	5	7	6
Other chemicals	284-85,287-89	(2)	(2)	(2)	(2)	(2)	(2)	13	16	15	14	16	19
Petroleum refining and related industries	29	51	61	65	58	60	71	80	95	92	97	82	87
Rubber products	30	0	0	2	2	2	3	3	3	(2)	2	1	1
Stone, clay, and glass products	32	4	7	5	4	6	7	9	11	9	7	9	5
Primary metals	33	9	13	24	31	29	25	29	30	24	22	20	24
Ferrous metals and products	331-32,3398-99	8	11	17	19	18	13	14	14	16	13	10	(2)
Nonferrous metals and products	333-36	1	3	7	12	12	12	15	15	9	9	11	(2)
Fabricated metal products	34	(2)	(2)	(2)	(2)	(2)	(2)	6	7	3	11	7	9
Machinery	35	14	25	23	29	32	38	31	30	34	30	31	34
Office, computing, and accounting machines	357	0	0	0	0	0	0	0	1	0	0	1	2
Other machinery, except electrical	351-56,358-59	14	25	23	29	31	37	30	29	34	30	30	32
Electrical equipment	36	13	16	19	18	20	19	34	39	39	31	28	30
Radio and TV receiving equipment	365	0	0	0	0	0	0	0	0	0	0	0	0
Communication equipment	366	(2)	(2)	(2)	5	6	6	5	6	(2)	(2)	(2)	(2)
Electronic components	367	0	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Other electrical equipment	361-64,369	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	25	23	24
Motor vehicles and motor vehicles equipment	371	380	384	347	413	487	593	(2)	(2)	(2)	(2)	(2)	(2)
Other transportation equipment	373-75,379	(2)	(2)	(2)	(2)	(2)	(2)	0	(2)	0	0	(2)	(2)
Aircraft and missiles	372,376	29	38	36	48	57	64	64	38	30	(2)	(2)	31
Professional and scientific instruments	38	(2)	(2)	(2)	(2)	3	4	3	(2)	(2)	(2)	3	2
Scientific and mechanical measuring instruments	381,82	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	1	1
Optical, surgical, photographic, and other instruments	383-87	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	2	1
Other manufacturing industries	21,27,31,39	2	2	1	2	3	3	2	3	(2)	(2)	2	5
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	36	29	34	55	61	102	104	79	77	65	94	105

[1] Data not available due to high rate of imputation or because of disclosure policy.
[2] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table 8-45. Company funds for pollution abatement research and development by selected industry: 1973-83

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	....	$568	$606	$606	$708	$861	(1)	$1,139	$1,095	(2)	(2)	(2)
Chemicals and allied products	28	(3)	(3)	(3)	57	64	(1)	113	130	128	123	115
Petroleum refining and related industries	29	50	59	64	59	82	(1)	(3)	93	92	97	82
Electrical equipment	36	(3)	(3)	(3)	11	11	(1)	17	19	19	19	23
Aircraft and missiles	372,376	9	13	29	37	49	(1)	(3)	26	20	22	17
All other manufacturing industries	....	(3)	(3)	(3)	494	573	(1)	(3)	705	(3)	(3)	(3)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	35	(3)	(3)	50	82	(1)	98	63	39	38	49

[1] Data not available for 1978.
[2] Data not available due to high rate of imputation or because of disclosure policy.
[3] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table 8-46. Federal funds for pollution abatement research and development by selected industry: 1973-83

[Dollars in millions]

Industry	SIC code	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	....	$35	$51	$41	$51	$57	(1)	$98	$107	$129	$122	$131
Chemicals and allied products	28	(2)	(2)	(2)	15	20	(1)	36	48	58	68	66
Petroleum refining and related industries	29	1	2	1	4	6	(1)	(2)	2	0	0	0
Electrical equipment	36	(2)	(2)	(2)	7	8	(1)	17	20	20	12	5
Aircraft and missiles	372,376	16	21	7	11	8	(1)	(2)	12	10	(2)	(2)
All other manufacturing industries	....	(2)	(2)	(2)	12	8	(1)	(2)	6	3	(2)	(2)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	0	(2)	(2)	2	7	(1)	15	16	38	26	44

[1] Data not available for 1978.
[2] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table 8-47. Industrial expenditures for pollution abatement research and development by type of pollution: 1973-84 (projected)

[Dollars in millions]

Type of pollution	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984 (projected)
Total	$603	$657	$647	$754	$901	$1,065	$1,249	$1,202	(1)	(1)	(1)	(1)
Air	461	508	478	569	[2]676	(3)	[2]954	(1)	(1)	(3)	(1)	(1)
Automotive emission	(3)	383	348	426	[2]495	(3)	[2]536	(3)	(1)	(3)	(1)	(1)
Electric power plant emissions	(3)	25	28	31	[2]67	(3)	[2]270	(3)	[2]27	(3)	23	19
All other	(3)	100	102	112	[2]114	(3)	[2]148	(3)	[2]112	(3)	91	94
Water	76	60	71	84	[2]97	(3)	[2]120	(3)	[2]105	(3)	124	109
Solid waste	10	14	23	21	[2]28	(3)	[2]44	(3)	[2]96	(3)	108	117
Other	56	75	75	80	[2]100	(3)	[2]131	(3)	[2]65	(3)	54	54

[1] Data not available due to high rate of imputation.
[2] Detailed data for 1977, 1979, and 1981 were estimated based upon (a) data actually reported in those years, (b) revised totals for those years which were reported on the 1978, 1980, and 1982 survey forms, and (c) adjustments due to new sample in 1981.
[3] Data not collected.

SOURCE: National Science Foundation.

Table B-48. Industrial expenditures for pollution abatement research and development by type of pollution and source of funds: 1982-83

[Dollars in millions]

Industry	1982			1983		
	Total	Federal	Company	Total	Federal	Company
Total	(1)	$122	(1)	(1)	$131	(1)
Air	(2)	(2)	(2)	(1)	(1)	(1)
Automotive emission	(2)	(2)	(2)	(1)	(1)	(1)
Electric power plant emissions	(2)	(2)	(2)	23	5	18
All other	(2)	(2)	(2)	91	(1)	82
Water	(2)	(2)	(2)	69	4	65
Solid waste	(2)	(2)	(2)	108	72	36
Other	(2)	(2)	(2)	54	(1)	40

[1] Data not available due to high rate of imputation.
[2] Data not collected.

SOURCE: National Science Foundation.

Table B-49. Company R&D expenditures to meet regulations by agency by selected industry: 1983[1]

(Dollars in millions)

Industry	SIC code	Coverage ratio[2]	Total	CPSC[3]	DOE[3]	EPA[3]	FAA[3]	FDA[3]	OSHA[3]	All other Federal	All other
Total	....	29	$2,256	$14	$1,670	$200	$62	$101	$61	$110	$38
Chemicals and allied products	28	42	548	2	308	55	0	94	20	61	8
Machinery	35	21	32	1	2	23	1	0	2	3	0
Electrical equipment	36	53	1,078	9	1,030	8	1	3	1	12	14
Motor vehicles and motor vehicles equipment	371	6	70	0	14	25	0	0	0	23	8
Aircraft and missiles	372,376	53	98	0	60	7	28	0	0	0	3
All other manufacturing and nonmanufacturing industries	....	24	430	2	256	82	32	4	38	11	5

Note: This table lists only R&D funds actually reported by those companies responding to this question on the survey. No attempt has been made to estimate national totals.

[1] Companies were asked to list only those funds spent for research and development which would not have been spent in the absence of those regulations.
[2] The percent of total company R&D funds represented by the firms which responded to this question.
[3] CPSC: Consumer Product Safety Commission; DOE: Department of Energy; EPA: Environmental Protection Agency; FAA: Federal Aviation Administration; FDA: Food and Drug Administration; OSHA: Occupational Safety and Health Administration.

SOURCE: National Science Foundation.

Table B-50. Geographic distribution of funds for industrial research and development: 1963, 1966-77, 1979, 1981, and 1983

[Dollars in millions]

Area	1963	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1979	1981	1983
United States	$12,630	$15,548	$16,385	$17,429	$18,308	$18,067	$18,320	$19,552	$21,249	$22,887	$24,187	$26,997	$29,825	$38,226	$51,810	$62,816
Northeast	3,818	5,092	5,438	5,867	6,095	6,333	6,510	6,869	6,735	7,291	7,403	8,096	8,687	10,296	14,270	18,245
New England	993	1,494	1,661	1,870	1,835	1,854	1,884	1,929	2,011	2,058	2,029	2,147	2,400	3,003	3,855	4,504
Maine	4	5	8	9	6	10	9	10	8	8	9	21	24	40	(1)	(1)
New Hampshire	6	27	49	43	49	49	52	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Vermont	6	15	14	20	32	34	61	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Massachusetts	481	826	915	986	977	1,004	1,082	1,141	1,135	1,080	1,022	1,156	1,349	1,690	1,907	2,373
Rhode Island	7	9	14	17	45	52	51	43	44	41	45	22	24	49	87	165
Connecticut	489	612	663	795	726	705	629	637	732	821	832	815	876	985	1,514	1,619
Middle Atlantic	2,825	3,598	3,777	3,997	4,260	4,479	4,626	4,940	4,724	5,233	5,374	5,949	6,287	7,293	10,415	13,741
New York	1,176	1,573	1,718	1,830	1,981	2,038	2,066	2,201	1,971	2,134	2,225	2,418	2,542	2,959	4,057	5,727
New Jersey	958	1,119	1,098	1,117	1,202	1,292	1,403	1,558	1,407	1,512	1,547	1,717	1,900	2,191	3,355	4,200
Pennsylvania	691	906	911	1,050	1,077	1,149	1,157	1,181	1,347	1,537	1,602	1,814	1,845	2,143	3,003	3,814
North Central	2,791	3,382	3,638	3,766	4,216	4,393	4,849	5,414	5,468	5,756	5,821	6,574	7,777	10,013	12,692	14,672
East North Central	2,230	2,857	3,157	3,291	3,570	3,624	3,837	4,314	4,424	4,704	4,816	5,390	6,270	8,065	9,742	11,517
Ohio	583	774	879	910	925	982	945	984	1,043	1,103	1,139	1,183	1,323	1,635	1,781	2,196
Indiana	236	316	377	386	431	428	448	459	387	403	453	469	541	723	1,054	(1)
Illinois	398	539	612	625	680	731	796	855	862	970	1,042	1,226	1,360	1,673	2,077	2,205
Michigan	862	1,049	1,089	1,162	1,305	1,259	1,413	1,733	1,883	2,016	1,961	2,249	2,750	3,614	4,272	5,501
Wisconsin	149	179	201	208	229	224	235	283	249	212	221	263	296	420	558	(1)
West North Central	562	525	480	475	646	769	1,012	1,100	1,044	1,052	1,005	1,184	1,507	1,948	2,950	3,155
Minnesota	149	225	239	250	298	289	294	332	341	411	403	551	602	802	1,180	1,746
Iowa	58	103	75	71	87	138	138	136	158	175	182	144	173	150	393	276
Missouri	304	156	125	99	211	(1)	(1)	569	484	399	350	398	630	746	1,137	(1)
North Dakota	0	0	0	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
South Dakota	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Nebraska	(1)	(1)	(1)	(1)	(1)	(1)	(1)	11	7	10	9	13	14	15	28	25
Kansas	47	30	34	45	41	50	36	49	49	51	60	76	84	216	211	282
South	1,701	2,437	2,414	2,531	2,488	2,341	2,472	2,450	2,601	2,891	2,964	3,442	3,691	4,496	6,987	8,943
South Atlantic	931	1,179	1,220	1,304	1,466	1,424	1,612	1,546	1,666	1,775	1,720	1,847	2,012	2,592	4,012	4,812
Delaware	26	41	37	26	34	51	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Maryland	241	275	254	310	301	361	369	386	423	481	446	452	382	424	(1)	(1)
District of Columbia	12	19	23	47	30	31	21	24	10	24	14	8	8	33	(1)	(1)
Virginia	93	(1)	(1)	(1)	(1)	(1)	133	131	194	244	236	264	318	464	539	906
West Virginia	89	59	63	61	54	48	40	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
North Carolina	71	124	120	138	157	175	140	143	203	227	235	253	268	327	546	756
South Carolina	28	47	48	51	59	65	(1)	58	38	30	37	87	96	82	(1)	(1)
Georgia	61	(1)	(1)	(1)	(1)	(1)	122	91	73	83	81	91	99	147	220	335
Florida	284	338	375	436	424	371	422	353	386	374	348	398	462	620	1,449	(1)
East South Central	280	487	473	416	364	346	342	327	356	388	401	427	467	402	624	969
Kentucky	22	41	48	51	53	55	52	61	73	67	74	79	100	209	170	184
Tennessee	139	206	221	199	194	183	191	181	190	231	261	282	306	(1)	(1)	(1)
Alabama	116	238	203	164	114	105	96	81	84	79	57	56	48	62	100	180
Mississippi	2	2	2	2	3	3	3	4	8	8	10	10	13	(1)	(1)	(1)
West South Central	491	771	721	811	658	571	519	577	579	728	843	1,113	1,212	1,502	2,351	3,162
Arkansas	2	5	5	6	5	7	5	5	4	9	13	12	10	11	52	(1)
Louisiana	131	237	154	127	103	38	51	66	55	74	88	98	106	83	158	247
Oklahoma	53	99	83	71	73	81	63	82	72	76	99	116	142	174	339	392
Texas	304	430	479	607	477	445	400	424	448	567	643	887	954	1,233	(1)	(1)
West	4,320	4,635	4,897	5,264	5,509	5,000	4,489	4,819	5,275	5,620	6,165	6,855	7,379	10,176	11,873	17,173
Mountain	465	446	489	596	651	687	570	576	621	622	782	923	1,034	1,139	2,135	2,738
Montana	(1)	(1)	(1)	(1)	0	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Idaho	27	(1)	(1)	(1)	(1)	(1)	30	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Wyoming	1	2	2	2	3	3	5	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	2
Colorado	126	108	119	139	149	217	140	130	146	166	194	250	257	269	529	713
New Mexico	(1)	146	154	151	179	179	(1)	163	149	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Arizona	86	116	125	180	197	152	155	171	212	199	243	203	200	372	758	(1)
Utah	71	18	21	21	25	22	17	26	43	61	91	112	132	142	265	233
Nevada	(1)	38	52	55	37	37	(1)	(1)	(1)	8	11	35	72	(1)	(1)	(1)
Pacific	3,854	4,189	4,407	4,668	4,858	4,313	3,919	4,243	4,654	4,958	5,384	5,932	6,345	9,037	9,738	14,435
Washington	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	484	499	610	681	(1)	(1)	(1)
Oregon	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	50	51	57	77	116	(1)	(1)
California	3,512	(1)	(1)	(1)	(1)	1,800	3,468	3,710	4,241	4,423	4,834	5,263	5,600	7,437	7,626	(1)
Alaska	0	0	0	0	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Hawaii	(1)	(1)	(1)	(1)	(1)	(1)	3	2	2	1	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed funds	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	1,146	1,302	1,803	2,030	2,291	3,245	(1)	3,783

[1] Not separately available but included in total. See general notes.

[2] For 1963-72 funds were allocated to individual states based on each one's share of total research and development and are included in regional and U.S. totals.

Source: National Science Foundation.

Table B-51. Geographic distribution of funds for industrial research and development by source of funds: 1983

[Dollars in millions]

Area	Total	Federal	Company
United States	$62,816	$20,215	$42,600
Northeast	18,245	4,188	14,057
New England	4,504	1,802	2,702
Maine	(1)	(1)	(1)
New Hampshire	(1)	(1)	45
Vermont	(1)	0	(1)
Massachusetts	2,373	(1)	(1)
Rhode Island	165	(1)	(1)
Connecticut	1,619	(1)	(1)
Middle Atlantic	13,741	2,386	11,355
New York	5,727	768	4,959
New Jersey	4,200	702	3,498
Pennsylvania	3,814	916	2,898
North Central	14,672	(1)	(1)
East North Central	11,517	484	11,033
Ohio	2,196	162	2,034
Indiana	(1)	219	(1)
Illinois	2,205	(1)	(1)
Michigan	5,501	(1)	(1)
Wisconsin	(1)	(1)	(1)
West North Central	3,155	(1)	(1)
Minnesota	1,746	(1)	(1)
Iowa	276	(1)	(1)
Missouri	(1)	(1)	(1)
North Dakota	(1)	(1)	(1)
South Dakota	(1)	0	(1)
Nebraska	25	(1)	(1)
Kansas	282	(1)	(1)
South	8,943	2,960	5,983
South Atlantic	4,812	1,509	3,303
Delaware	(1)	(1)	(1)
Maryland	(1)	(1)	(1)
District of Columbia	(1)	(1)	0
Virginia	906	394	512
West Virginia	(1)	(1)	(1)
North Carolina	756	(1)	(1)
South Carolina	(1)	(1)	80
Georgia	335	(1)	(1)
Florida	(1)	(1)	(1)
East South Central	969	448	521
Kentucky	184	(1)	(1)
Tennessee	(1)	(1)	127
Alabama	180	124	56
Mississippi	(1)	(1)	(1)
West South Central	3,162	1,003	2,159
Arkansas	(1)	(1)	(1)
Louisiana	247	(1)	(1)
Oklahoma	392	(1)	(1)
Texas	(1)	(1)	1,580
West	17,173	11,200	5,973
Mountain	2,738	1,361	1,377
Montana	(1)	(1)	(1)
Idaho	(1)	(1)	(1)
Wyoming	2	(1)	(1)
Colorado	713	(1)	(1)
New Mexico	(1)	(1)	(1)
Arizona	(1)	(1)	(1)
Utah	233	(1)	(1)
Nevada	(1)	(1)	(1)
Pacific	14,435	9,839	4,596
Washington	(1)	(1)	(1)
Oregon	(1)	(1)	(1)
California	(1)	(1)	4,222
Alaska	(1)	0	(1)
Hawaii	(1)	(1)	(1)
Undistributed funds	3,783	(1)	(1)

[1] Not separately available but included in total. See general notes.

Table B-52. Distribution of R&D costs by industry and type of cost: 1983

[Dollars in millions]

Industry	SIC code	Coverage ratio[1]	R&D costs	Wages of R&D personnel	Materials and supplies	Overhead costs
Total....................................	....	.58	$62,816	$28,647	$10,652	$23,517
Food and kindred products........................	20	.45	(2)	(2)	(2)	(2)
Textiles and apparel.............................	22,23	.47	(2)	(2)	(2)	(2)
Lumber, wood products, and furniture.............	24,25	.41	171	102	(2)	(2)
Paper and allied products........................	26	.83	(2)	366	(2)	194
Chemicals and allied products....................	28	.56	7,287	3,539	1,064	2,683
Industrial chemicals...........................	281-82,286	.60	3,409	(2)	(2)	1,241
Drugs and medicines............................	283	.48	(2)	(2)	(2)	(2)
Other chemicals................................	284-85,287-89	.63	(2)	(2)	(2)	351
Petroleum refining and related industries........	29	.67	(2)	895	(2)	1,017
Rubber products..................................	30	.37	(2)	(2)	(2)	(2)
Stone, clay, and glass products..................	32	.69	(2)	242	(2)	205
Primary metals...................................	33	.43	1,096	(2)	(2)	(2)
Ferrous metals and products....................	331-32,3398-99	.34	(2)	(2)	(2)	(2)
Nonferrous metals and products.................	333-36	.66	(2)	167	(2)	100
Fabricated metal products........................	34	.48	634	(2)	(2)	(2)
Machinery..	35	.73	8,382	3,754	1,584	3,044
Office, computing, and accounting machines.....	357	.84	(2)	2,229	(2)	2,991
Other machinery, except electrical.............	351-56,358-59	.71	(2)	1,525	(2)	53
Electrical equipment.............................	36	.62	13,651	5,914	2,415	5,322
Radio and TV receiving equipment...............	365	.82	(2)	249	(2)	(2)
Communication equipment........................	366	.67	6,724	2,741	988	2,995
Electronic components..........................	367	.32	2,016	(2)	(2)	(2)
Other electrical equipment.....................	361-64,369	.67	(2)	1,910	(2)	1,313
Motor vehicles and motor vehicles equipment......	371	.49	5,372	(2)	(2)	(2)
Other transportation equipment...................	373-75,379	.53	(2)	68	(2)	74
Aircraft and missiles............................	372,376	.67	13,741	5,200	2,686	5,855
Professional and scientific instruments..........	38	.17	4,387	(2)	(2)	(2)
Scientific and mechanical measuring instruments..................................	381-82	.27	(2)	(2)	(2)	(2)
Optical, surgical, photographic, and other instruments..................................	383-87	.09	(2)	(2)	(2)	(2)
Other manufacturing industries...................	21,27,31,39	.40	(2)	306	(2)	(2)
Nonmanufacturing industries......................	07-17,41-67,737, 739,807,891	.47	2,065	(2)	(2)	(2)

[1] The coverage ratio is derived by dividing R&D funds for which a distribution by type of cost was reported by total R&D funds, including those for which a distribution was not reported.

[2] Not separately available but included in total. See general notes.

Source: National Science Foundation.

Table B-53. Full-time-equivalent number of R&D scientists and engineers by industry and size of company: 1957-58, 1963-64, 1967-68, and 1973-84

[In thousands]

Industry and size of company	SIC code	January																	
		1957	1958	1963	1964	1967	1968	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Total	....	229.4	234.8	327.3	340.2	367.2	376.7	357.7	360.0	363.3	364.4	382.8	404.4	423.9	450.6	487.8	509.8	522.1	537.8
Distribution by industry																			
Food and kindred products	20	3.8	4.8	5.1	5.7	6.1	6.3	6.6	6.4	6.8	6.9	6.9	6.9	7.4	7.2	7.4	7.4	7.8	8.1
Textiles and apparel	22,23	.7	.8	1.0	1.2	1.9	2.5	1.9	1.8	1.8	1.8	1.7	1.8	1.8	(1)	2.0	1.9	2.0	1.7
Lumber, wood products, and furniture	24,25	.8	.8	.5	.5	.5	.5	1.9	2.1	2.3	2.1	2.1	2.0	1.8	1.7	1.6	(1)	1.8	(1)
Paper and allied products	26	1.5	1.7	2.5	3.8	4.7	4.8	4.9	4.9	5.0	5.2	6.3	6.5	7.1	7.4	8.0	8.4	8.3	8.5
Chemicals and allied products	28	29.4	31.0	38.3	35.8	36.9	38.9	40.9	41.8	45.2	44.4	46.4	48.3	50.0	51.4	54.7	61.6	66.0	67.5
Industrial chemicals	281-82,286	18.0	18.8	22.9	22.2	21.7	22.3	19.1	19.1	21.1	20.1	20.6	21.3	21.4	20.9	21.6	25.9	27.2	26.7
Drugs and medicines	283	4.7	5.1	6.9	6.9	8.7	9.8	13.0	14.0	15.6	16.6	17.8	19.5	20.8	21.6	23.3	25.6	28.2	(1)
Other chemicals	284-85,287-89	6.7	7.1	8.5	6.7	6.5	6.8	8.8	8.7	8.5	7.8	8.0	7.5	7.8	8.9	9.8	10.1	10.6	10.5
Petroleum refining and related industries	29	6.9	7.4	8.9	8.1	8.7	9.2	8.2	8.2	8.4	8.6	8.9	9.9	10.1	10.8	13.0	15.6	14.7	13.4
Rubber products	30	4.7	4.7	5.8	6.0	5.8	6.1	7.5	7.7	8.4	8.6	9.1	7.9	8.1	(1)	10.3	8.1	(1)	(1)
Stone, clay, and glass products	32	(2)	(2)	3.8	3.3	3.3	4.1	4.2	4.5	4.5	4.6	4.5	5.1	5.2	5.4	5.6	5.1	5.0	4.4
Primary metals	33	5.1	5.2	5.2	5.1	5.9	5.9	6.0	6.4	6.3	8.1	8.4	8.1	7.9	8.1	7.9	8.4	8.4	8.1
Ferrous metals and products[3]	331-32,3398-99	2.9	3.0	2.9	2.8	3.3	3.1	3.2	3.3	3.3	3.9	3.9	4.2	4.3	4.7	4.8	5.2	5.3	5.3
Nonferrous metals and products[3]	333-36	2.2	2.2	2.3	2.3	2.5	2.7	2.8	3.1	3.0	4.2	4.5	3.9	3.6	3.4	3.1	3.2	3.1	2.8
Fabricated metal products	34	8.4	8.3	6.8	7.0	6.3	5.6	6.7	7.3	7.4	6.8	7.1	7.0	6.8	7.8	7.8	8.2	(1)	7.8
Machinery	35	24.9	27.4	31.4	27.3	33.6	37.4	46.3	51.0	52.8	55.7	55.3	57.8	60.2	62.1	69.2	76.0	76.3	75.6
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	(4)	(4)	30.1	34.5	36.1	38.1	37.7	38.9	40.9	41.8	43.7	48.1	49.6	51.1
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	18.9	19.3	20.3	25.5	27.9	26.7	24.5
Electrical equipment	36	42.9	47.9	85.8	89.5	98.6	98.4	85.4	82.6	82.6	80.3	84.1	84.4	85.0	94.5	106.9	109.8	110.3	117.5
Radio and TV receiving equipment	365	(6)	(6)	(6)	(6)	.9	1.0	1.4	1.3	1.0	1.1	.9	1.5	2.1	4.0	7.9	7.8	(1)	(1)
Communication equipment	366	19.2	22.3	55.1	60.4	66.7	67.4	45.3	42.0	40.2	37.4	38.0	39.0	40.4	42.4	44.2	45.9	47.3	52.6
Electronic components	367							9.4	9.6	10.6	10.2	13.0	14.2	14.0	18.1	22.8	24.4	24.5	(1)
Other electrical equipment	361-64,369	23.7	25.6	30.7	29.1	31.0	30.0	29.3	29.7	30.8	31.6	32.2	29.7	28.5	30.0	32.0	31.7	(1)	31.6
Motor vehicles and motor vehicles equipment	371	13.6	15.0	21.1	23.3	25.2	24.3	28.2	27.4	26.0	25.4	28.2	31.9	35.2	38.2	35.1	30.0	29.0	28.8
Other transportation equipment	373-75,379							1.7	1.8	1.9	1.7	1.9	1.9	2.0	1.5	1.4	1.2	1.9	(1)
Aircraft and missiles	372,376	58.7	58.6	90.7	101.1	100.4	101.1	72.1	70.6	67.5	66.9	72.0	82.0	86.5	85.9	95.2	91.1	95.5	97.5
Professional and scientific instruments	38	10.2	11.0	9.4	10.8	13.0	14.1	16.3	17.5	17.9	18.8	20.5	23.3	27.0	32.8	34.7	42.7	(1)	(1)
Scientific and mechanical measuring instruments	381-82	5.8	6.5	3.9	3.8	3.6	3.8	5.3	5.6	5.9	6.7	7.2	9.0	11.7	(1)	18.6	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	4.4	4.5	5.5	7.0	9.4	10.3	11.0	11.9	12.0	12.1	13.3	14.3	15.3	16.3	16.0	16.1	(1)	(1)
Other manufacturing industries	21,27,31,39	17.8	19.2	2.8	2.0	2.2	2.4	3.6	3.7	3.7	4.2	4.5	4.6	4.7	4.6	4.8	5.5	6.1	(1)
Nonmanufacturing industries	07-17,41-67,737,739,807,891			8.2	9.8	14.1	15.1	15.3	14.4	14.9	14.6	15.3	15.0	17.1	19.8	22.2	27.1	26.2	29.3
Distribution by size of company (based on number of employees)																			
Less than 1,000	....	44.8	48.8	34.1	32.5	27.4	27.2	29.0	28.0	30.1	30.2	31.1	29.5	30.5	34.4	38.0	40.7	42.6	41.7
1,000 to 4,999	....	22.4	24.0	35.0	34.5	30.5	29.9	28.9	28.8	29.9	29.3	28.9	27.5	30.9	34.8	38.9	42.8	44.6	48.1
5,000 to 9,999	....	162.2	171.0	258.2	273.2	24.0	24.6	27.0	26.4	27.4	26.1	28.6	28.7	30.7	29.6	27.2	36.6	29.5	30.6
10,000 to 24,999	....					285.3	295.0	45.1	45.9	47.4	50.6	49.3	52.1	55.6	64.4	71.8	77.0	83.6	82.3
25,000 or more	....							227.7	230.9	228.5	228.2	244.9	266.6	276.2	287.4	311.8	312.7	321.7	335.1

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[1] Not separately available but included in total. See general notes.

[2] Data included in the other manufacturing industries group.

[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for January 1957-64.

[4] Data not tabulated at this level prior to the 1972 survey.

[5] Data not tabulated at this level prior to the 1977 survey.

[6] Included in the other electrical equipment group.

SOURCE: National Science Foundation.

61

Table B-54. Full-time-equivalent number of R&D scientists and engineers by industry and source of R&D funds: January 1984

Industry	SIC code	Total	Federal	Company
Total	....	537,800	138,200	399,600
Food and kindred products	20	8,100	(1)	(1)
Textiles and apparel	22,23	1,700	(1)	(1)
Lumber, wood products, and furniture	24,25	(1)	0	(1)
Paper and allied products	26	8,500	(1)	(1)
Chemicals and allied products	28	67,500	4,000	63,500
Industrial chemicals	281-82,286	26,700	3,400	23,300
Drugs and medicines	283	(1)	(1)	(1)
Other chemicals	284-85,287-89	10,500	(1)	(1)
Petroleum refining and related industries	29	13,400	(1)	(1)
Rubber products	30	(1)	(1)	(1)
Stone, clay, and glass products	32	4,400	(1)	(1)
Primary metals	33	8,100	(1)	(1)
Ferrous metals and products	331-32,3398-99	5,300	(1)	(1)
Nonferrous metals and products	333-36	2,800	(1)	(1)
Fabricated metal products	34	7,800	700	7,100
Machinery	35	75,600	9,500	66,100
Office, computing, and accounting machines	357	51,100	(1)	(1)
Other machinery, except electrical	351-56,358-59	24,500	(1)	(1)
Electrical equipment	36	117,500	41,700	75,800
Radio and TV receiving equipment	365	(1)	(1)	(1)
Communication equipment	366	52,600	(1)	(1)
Electronic components	367	(1)	(1)	(1)
Other electrical equipment	361-64,369	31,600	12,100	19,500
Motor vehicles and motor vehicles equipment	371	28,800	5,400	23,400
Other transportation equipment	373-75,379	(1)	(1)	(1)
Aircraft and missiles	372,376	97,500	58,300	39,200
Professional and scientific instruments	38	(1)	(1)	(1)
Scientific and mechanical measuring instruments	381-82	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	(1)	(1)	(1)
Nonmanufacturing industires	07-17,41-67,737, 739,807,891	29,300	(1)	(1)

[1] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-55. Cost per R&D scientist or engineer by industry and size of company: 1957-58, 1963, 1967, and 1972-83

Industry and size of company	SIC code	1957	1958	1963	1967	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	....	$32,700	$32,800	$37,800	$44,100	$55,300	$59,200	$63,300	$66,500	$72,200	$75,800	$80,400	$87,400	$94,900	$103,900	$112,400	$118,500
Distribution by industry																	
Food and kindred products	20	17,200	16,800	25,200	29,500	39,500	41,400	45,200	48,900	51,400	60,100	66,000	72,300	84,900	(1)	(1)	(1)
Textiles and apparel	22,23	20,000	28,900	26,400	25,900	32,100	34,900	38,300	38,900	46,900	47,400	49,400	53,200	57,500	(1)	(1)	(1)
Lumber, wood products, and furniture	24,25	17,500	13,300	22,000	24,000	33,700	35,500	38,200	40,000	51,000	60,000	66,300	79,400	89,700	(1)	(1)	(1)
Paper and allied products	26	21,900	22,700	27,000	26,900	38,600	38,900	47,900	48,800	54,400	52,000	56,900	61,400	64,300	(1)	75,000	(1)
Chemicals and allied products	28	23,300	24,600	32,600	39,800	47,100	51,100	56,300	60,900	66,500	67,600	72,800	79,600	87,400	96,600	104,400	109,200
Industrial chemicals	281-82,286	27,400	28,400	34,800	43,900	54,000	58,600	63,500	67,500	74,700	79,600	84,200	92,800	103,400	118,000	124,300	126,500
Drugs and medicines	283	21,200	23,300	30,200	37,100	46,500	51,500	54,300	60,900	63,400	59,900	64,800	71,400	79,200	(1)	(1)	(1)
Other chemicals	284-85,287-89	14,200	15,300	27,900	29,800	33,400	34,000	45,300	43,200	50,800	53,800	61,600	66,500	66,500	(1)	(1)	(1)
Petroleum refining and related industries	29	29,500	32,600	35,400	41,500	57,100	60,400	74,900	81,500	87,200	97,700	106,000	120,800	130,400	(1)	(1)	(1)
Rubber products	30	22,800	18,700	26,500	30,600	53,100	56,100	58,300	54,900	56,700	57,800	61,600	(1)	(1)	(1)	(1)	(1)
Stone, clay, and glass products	32	(2)	(2)	26,000	36,800	43,600	45,200	48,200	51,200	57,800	59,800	62,900	67,200	73,800	(1)	(1)	(1)
Primary metals	33	21,000	24,000	35,700	41,000	44,700	49,500	55,900	61,500	61,300	65,200	70,000	79,300	91,000	107,700	119,000	132,800
Ferrous metals and products[3]	331-32,3398-99	21,700	24,600	37,400	42,200	44,200	50,200	54,800	59,700	65,600	70,100	73,900	83,300	93,300	(1)	(1)	(1)
Nonferrous metals and products[3]	333-36	20,000	23,200	33,500	41,200	44,800	48,300	57,100	63,300	57,500	60,500	65,600	74,000	87,700	(1)	(1)	(1)
Fabricated metal products	34	16,200	18,800	22,200	27,400	37,800	41,600	42,300	45,600	51,500	54,800	55,700	62,300	70,500	78,000	(1)	(1)
Machinery	35	25,600	27,500	31,000	37,400	48,000	52,400	57,500	58,900	62,800	68,600	72,600	78,900	89,900	93,900	102,900	110,400
Office, computing, and accounting machines	357	(4)	(4)	(4)	(4)	48,500	53,700	59,600	59,800	63,400	69,300	72,300	77,700	92,700	(1)	(1)	(1)
Other machinery, except electrical	351-56,358-59	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(1)	73,300	81,400	84,700	(1)	(1)	(1)
Electrical equipment	36	39,700	38,200	33,000	39,300	55,400	58,400	60,700	62,700	68,600	69,900	76,800	87,200	91,100	95,300	105,800	119,900
Radio and TV receiving equipment	365	(6)	(6)	(6)	47,400	26,700	37,500	44,300	47,600	52,000	96,000	72,200	80,300	93,400	(1)	(1)	(1)
Communication equipment	366	36,000	34,600	31,700	36,200	57,800	59,800	59,000	61,300	66,100	70,800	75,500	87,800	92,900	105,500	123,400	134,600
Electronic components	367					33,700	42,700	48,400	52,700	59,600	56,600	66,000	72,800	75,600	66,700	67,900	(1)
Other electrical equipment	361-64,369	42,800	41,900	35,400	45,800	59,700	62,200	67,700	68,000	74,700	74,200	85,100	94,900	98,300	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	49,400	53,800	49,400	54,700	68,100	86,500	89,500	91,100	103,700	111,700	115,600	122,900	135,200	167,400	162,900	185,900
Other transportation equipment	373-75,379					32,900	40,000	45,800	50,000	52,200	63,200	67,200	90,900	111,700	(1)	(1)	(1)
Aircraft and missiles	372,376	43,900	41,900	49,600	56,300	69,200	70,800	76,400	85,100	91,300	91,300	89,400	93,300	101,600	128,400	146,400	142,400
Professional and scientific instruments	38	23,500	25,600	29,900	40,000	53,200	56,900	60,700	63,900	66,700	71,700	79,400	83,800	89,700	93,400	(1)	(1)
Scientific and mechanical measuring instruments	381-82	22,600	23,100	18,400	28,100	32,600	34,100	38,400	42,200	46,800	55,800	64,700	(1)	(1)	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	24,700	29,100	37,500	44,500	62,800	67,700	71,500	75,300	77,900	81,100	89,700	98,400	103,800	(1)	(1)	(1)
Other manufacturing industries	21,27,31,39	(1)	(1)	23,700	39,100	40,600	43,300	47,800	51,900	51,700	53,400	57,200	61,900	77,400	(1)	(1)	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	(1)	(1)	31,000	38,300	45,600	49,300	52,400	49,700	56,500	63,200	76,600	83,500	86,400	77,200	75,200	74,400
Distribution by size of company (based on number of employees)																	
Less than 1,000	....	[7]11,600	12,000	18,600	25,200	32,400	32,900	36,400	40,500	45,200	46,700	47,900	53,500	56,300	56,600	60,000	68,800
1,000 to 4,999	....	27,200	25,100	29,400	33,700	40,600	43,200	46,700	46,800	51,600	54,100	66,100	70,200	68,600	77,000	82,400	86,800
5,000 to 9,999	....	[7]39,400	38,700	41,400	36,700	38,800	43,700	50,000	55,300	60,300	61,600	52,200	56,100	71,400	93,700	83,400	98,000
10,000 to 24,999	....				45,800	48,700	49,100	51,800	53,700	57,500	63,500	79,400	84,100	86,200	90,900	97,300	103,500
25,000 or more	....					63,600	68,700	72,700	76,600	82,700	80,000	88,800	96,200	105,800	117,200	130,300	135,100

Note: The number of R&D scientists and engineers is derived by using the arithmetic mean of the full-time-equivalent of R&D scientists and engineers employed in the Januaries of two consecutive years.

[1] Not separately available but included in total. See general notes.
[2] Included in the other manufacturing group.
[3] SIC codes 3398 and 3399 included in the nonferrous metals and products group for 1957-63.
[4] Data not tabulated at this level prior to 1972.
[5] Data not tabulated at this level prior to 1977.
[6] Included in the other electrical equipment group.
[7] Estimated by the National Science Foundation.

SOURCE: National Science Foundation.

Table B-56. Cost per R&D scientist or engineer[1] by industry and size of company: 1983

Industry	SIC code	Companies with total employment of--					
		Total	Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	$25,000 or more
Total		$118,500	$68,800	$86,800	$98,000	$103,500	$135,500
Food and kindred products	20	(2)	89,700	79,800	109,100	(2)	121,500
Textiles and apparel	22,23	(2)	41,900	91,200	89,700	65,700	(2)
Lumber, wood products, and furniture	24,25	(2)	61,400	92,300	135,600	91,100	(2)
Paper and allied products	26	(2)	(2)	81,300	43,100	103,500	(2)
Chemicals and allied products	28	109,200	62,000	(2)	(2)	102,100	126,600
Industrial chemicals	281-82,286	126,500	64,400	(2)	(2)	110,000	134,600
Drugs and medicines	283	(2)	(2)	(2)	90,000	(2)	(2)
Other chemicals	284-85,287-89	(2)	(2)	78,300	112,700	(2)	(2)
Petroleum refining and related industries	29	(2)	(2)	(2)	(2)	(2)	(2)
Rubber products	30	(2)	48,300	84,200	(2)	(2)	82,200
Stone, clay, and glass products	32	(2)	80,400	(2)	94,700	(2)	125,200
Primary metals	33	132,800	(2)	107,700	(2)	89,800	(2)
Ferrous metals and products	331-32,3398-99	(2)	52,700	(2)	(2)	(2)	193,400
Nonferrous metals and products	333-36	(2)	(2)	(2)	88,000	(2)	(2)
Fabricated metal products	34	(2)	54,000	100,000	(2)	(2)	(2)
Machinery	35	110,400	61,800	80,800	(2)	(2)	135,300
Office, computing, and accounting machines	357	(2)	(2)	78,100	87,500	(2)	(2)
Other machinery, except electrical	3[illegible],358-59	(2)	(2)	83,200	(2)	(2)	(2)
Electrical equipment	36	129,900	65,400	84,800	95,600	111,800	131,400
Radio and TV receiving equipment	365	(2)	(2)	86,200	(2)	(2)	(2)
Communication equipment	366	134,600	(2)	96.600	(2)	126,900	141,000
Electronic components	367	(2)	(2)	(2)	75,100	97,700	(2)
Other electrical equipment	361-64,369	(2)	(2)	(2)	(2)	103,500	156,700
Motor vehicles and motor vehicles equipment	371	185,900	67,400	(2)	(2)	(2)	(2)
Other transportation equipment	373-75,379	(2)	(2)	87,000	98,300	(2)	101,100
Aircraft and missiles	372,376	142,400	(2)	185,800	(2)	149,000	142,000
Professional and scientific instruments	38	(2)	(2)	81,200	(2)	(2)	108,100
Scientific and mechanical measuring instruments	381-82	(2)	(2)	72,300	(2)	65,000	75,500
Optical, surgical, photographic, and other instruments	383-87	(2)	(2)	117,600	(2)	(2)	161,600
Other manufacturing industries	21,27,31,39	(2)	38,900	85,800	106,200	(2)	101,700
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	74,400	66,200	95,300	(2)	(2)	(2)

[1] See note on table B-55.
[2] Not separately available but included in total. See general notes.

SOURCE: National Science Foundation.

Table B-57. Cost per R&D scientist or engineer[1] in companies ranked by size of R&D program: 1972-83

Companies ranked by size of R&D program (based on total R&D funds)	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
First 4	$64,500	$68,500	$80,700	$90,500	$102,500	$105,200	$109,400	$121,700	$126,700	$160,200	$182,800	185,700
Next 4	76,300	81,700	80,500	84,000	87,600	94,600	103,800	105,700	119,200	138,900	127,600	137,100
Next 12	63,100	73,200	76,900	80,600	82,900	79,300	83,800	90,500	93,300	107,000	127,500	127,600
Next 20	57,500	60,400	62,200	66,400	68,200	75,900	80,800	87,600	97,400	101,700	104,200	111,000
Next 60	51,000	52,700	66,200	61,400	65,200	69,900	74,200	80,100	90,700	96,400	98,000	108,300
Next 100	41,600	45,400	49,900	52,400	53,400	57,200	58,700	63,400	71,400	87,900	99,200	100,100
Next 200	39,700	43,600	44,000	43,600	48,300	54,200	56,900	61,200	72,800	79,900	86,900	93,200
Average of above 400 R&D performing companies	57,200	61,300	66,900	70,400	74,300	78,100	82,200	88,500	96,600	114,400	118,500	124,200
Average of R&D performing companies less above 400	28,300	29,100	32,800	40,100	44,000	44,900	46,200	47,400	56,300	58,600	65,100	71,100

[1] See note on table B-55.

SOURCE: National Science Foundation.

Table B-58. Total employment of R&D-performing companies by industry and size of company: 1982-83

[In thousands]

Industry	SIC code	1982						1983					
			Companies with total employment of--						Companies with total employment of--				
		Total	Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more	Total	Less than 1,000	1,000 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 or more
Total	....	15,596	1,444	2,011	1,464	3,166	7,512	15,238	1,285	1,846	1,428	3,113	7,566
Food and kindred products	20	1,291	188	134	150	346	473	1,228	72	135	158	360	502
Textiles and apparel	22,23	529	74	76	90	170	118	536	91	83	91	158	113
Lumber, wood products, and furniture	24,25	279	43	60	(1)	33	(1)	277	32	65	62	(1)	(1)
Paper and allied products	26	518	21	70	62	206	159	509	20	68	64	205	151
Chemicals and allied products	28	1,281	95	136	109	401	539	1,254	92	131	103	403	524
Industrial chemicals	281-82,286	620	20	35	57	99	409	598	20	22	53	100	393
Drugs and medicines	283	364	22	35	(1)	195	(1)	370	23	35	(1)	202	(1)
Other chemicals	284-85,287-89	297	53	67	(1)	107	(1)	286	50	64	(1)	101	(1)
Petroleum refining and related industries	29	672	(1)	15	(1)	112	528	641	6	17	15	89	515
Rubber products	30	360	59	66	24	98	113	365	71	68	23	97	107
Stone, clay, and glass products	32	356	(1)	36	60	139	(1)	341	50	38	(1)	136	(1)
Primary metals	33	880	47	119	79	259	377	746	43	107	71	215	309
Ferrous metals and products	331-32,3398-99	667	29	80	59	157	342	549	23	70	(1)	124	(1)
Nonferrous metals and products	333-36	213	18	39	20	102	35	197	20	38	(1)	91	(1)
Fabricated metal products	34	499	106	132	90	45	127	465	94	126	84	52	108
Machinery	35	1,690	260	293	167	307	662	1,529	240	259	151	268	611
Office, computing, and accounting machines	357	648	35	58	20	85	450	648	32	62	20	85	449
Other machinery, except electrical	351-56,358-59	1,042	225	235	147	223	212	881	208	197	130	184	162
Electrical equipment	36	1,963	156	194	108	314	1,191	2,106	156	191	112	307	1,340
Radio and TV receiving equipment	365	146	15	13	(1)	(1)	(1)	197	13	13	(1)	(1)	(1)
Communication equipment	366	644	34	39	22	92	458	771	36	38	22	88	586
Electronic components	367	368	48	54	21	46	200	362	48	50	21	47	197
Other electrical equipment	361-64,369	804	59	88	(1)	(1)	(1)	776	59	91	(1)	(1)	(1)
Motor vehicles and motor vehicles equipment	371	939	25	39	42	78	756	958	21	43	41	86	764
Other transportation equipment	373-75,379	154	(1)	39	(1)	12	60	135	5	26	(1)	(1)	77
Aircraft and missiles	372,376	940	15	23	38	80	783	921	15	23	32	81	771
Professional and scientific instruments	38	611	89	84	73	62	303	623	94	80	67	83	299
Scientific and mechanical measuring instruments	381-82	281	45	49	(1)	(1)	117	275	50	48	(1)	(1)	113
Optical, surgical, photographic, and other instruments	383-87	329	44	35	(1)	(1)	186	348	44	32	(1)	(1)	186
Other manufacturing industries	21,27,31,39	691	75	137	78	158	243	695	77	116	75	160	267
Nonmanufacturing industries	07-17,41-67,737, 739,807,891	1,945	110	357	206	344	928	1,910	103	268	207	372	959

[1] Not separately available but included in total See general notes.

SOURCE: National Science Foundation.

66

Table B-59. R&D scientists and engineers per 1,000 employees by industry and size of company: 1958, 1963, 1967, and 1972-83

Industry and size of company	SIC code	1958	1963	1967	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	198.	1983
Distribution by industry																
Total	....	21	28	27	24	24	25	26	27	27	27	27	27	29	33	35
Food and kindred products	20	6	7	7	7	7	7	7	7	7	7	6	5	6	6	6
Textiles and apparel	22,23	1	3	3	3	3	3	3	3	3	3	3	3	3	4	4
Lumber, wood products, and furniture	24,25	5	4	4	6	7	7	7	7	7	7	6	6	(1)	(1)	(1)
Paper and allied products	26	6	6	6	8	8	8	10	12	12	14	14	14	16	16	16
Chemicals and allied products	28	39	40	36	39	39	40	41	40	42	43	42	42	44	51	53
Industrial chemicals	281-82,286	42	40	33	34	36	37	38	36	38	38	36	36	37	44	45
Drugs and medicines	283	46	47	51	60	57	57	59	64	62	65	62	60	66	74	(1)
Other chemicals	284-85,287-89	30	38	33	31	29	30	29	28	29	27	27	30	33	36	37
Petroleum refining and related industries	29	15	17	18	16	17	18	19	17	17	19	18	17	20	22	22
Rubber products	30	19	20	17	16	17	17	18	18	19	18	(1)	(1)	25	(1)	(1)
Stone, clay, and glass products	32	(1)	12	14	10	10	11	11	11	12	13	13	13	13	14	14
Primary metals	33	5	5	5	5	5	5	7	8	8	8	7	7	8	10	11
Ferrous metals and products[2]	331-32,3398-99	4	4	4	4	4	4	5	5	5	6	6	6	6	8	10
Nonferrous metals and products[2]	333-36	6	8	8	7	8	7	11	15	13	12	12	12	13	14	15
Fabricated metal products	34	16	15	14	10	11	11	12	12	12	12	12	14	15	(1)	(1)
Machinery	35	22	28	28	31	31	34	36	38	38	39	38	36	35	45	50
Office, computing, and accounting machines	357	(3)	(3)	(3)	66	65	69	76	79	78	79	75	72	71	75	78
Other machinery, except electrical	351-56,358-59	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	18	19	19	18	19	26	29
Electrical equipment	36	43	55	43	37	37	37	40	42	42	41	43	44	48	56	54
Radio and TV receiving equipment	365	(5)	(5)	18	26	20	18	16	15	17	22	29	35	51	(1)	(1)
Communication equipment	366	52	67	52	42	43	43	44	45	46	48	53	55	56	73	65
Electronic components	367				39	40	40	49	55	54	51	52	55	66	67	(1)
Other electrical equipment	361-64,369	37	41	35	31	31	32	36	38	35	32	32	32	34	(1)	(1)
Motor vehicles and motor vehicles equipment	371	16	19	20	23	22	24	25	25	24	26	26	30	30	31	30
Other transportation equipment	373-75,379				14	13	13	13	14	13	13	11	9	9	10	(1)
Aircraft and missiles	372,376	72	99	89	76	68	72	72	78	85	96	93	92	98	99	105
Professional and scientific instruments	38	44	36	32	33	34	35	38	41	41	42	41	39	46	(1)	(1)
Scientific and mechanical measuring instruments	381-82	57	38	26	31	33	35	41	45	45	50	(1)	(1)	(1)	(1)	(1)
Optical, surgical, photographic, and other instruments	383-87	33	35	35	34	35	35	37	38	41	44	45	48	47	(1)	(1)
Other manufacturing industries	21,27,31,39	(1)	9	6	6	6	6	7	8	7	9	7	7	7	9	(1)
Nonmanufacturing industries	07-17,41-67,737, 739,807,891		9	13	21	18	17	16	19	16	14	13	11	12	13	15
Distribution by size of company (based on number of employees)																
Less than 1,000	....	18	27	28	28	26	29	26	25	24	25	24	25	28	30	33
1,000 to 4,999	....	12	19	16	19	17	17	17	17	17	18	18	19	21	22	25
5,000 to 9,999	....	25	31	15	19	18	18	17	19	20	17	19	19	18	23	21
10,000 to 24,999	....			31	16	16	16	17	18	19	20	19	20	23	26	27
25,000 or more	....				31	31	33	35	34	35	34	34	34	36	43	43

Note: The number of R&D scientists and engineers for 1982 is derived by dividing the arithmetic mean of scientists and engineers employed in January 1981 and January 1982 by the number of company employees in all activities in March 1981. Similar procedures were used in earlier years except 1967-69 in which data were derived by dividing the worker-years of R&D scientists and engineers for the year by the March employment figures.

67

[1] Not separately available but included in total. See general notes.

[2] SIC codes 3398 and 3399 included in the nonferrous metals products group for 1958-63.

[3] Data not tabulated at this level prior to the 1972 survey.

[4] Data not tabulated at this level prior to the 1977 survey.

[5] Included in the other electrical equipment group for 1958-63.

SOURCE: National Science Foundation.

Table B-60. Total and company R&D funds per employee by size of company: 1963, 1967 and 1972-83

Size of company (based on number of employees)	1963	1967	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
	Total R&D funds per employee													
Total............	$1,110	$1,180	$1,386	$1,468	$1,624	$1,728	$1,912	$2,077	$2,240	$2,453	$2,576	$3,010	$3,719	$4,122
Less than 1,000........	520	660	892	863	1,010	1,043	1,139	1,051	1,123	1,254	1,418	1,634	1,732	2,256
1,000 to 4,999.........	580	570	757	758	791	786	852	963	1,066	1,321	1,326	1,596	1,790	2,179
5,000 to 9,999.........	1,310	560	736	790	879	930	1,138	1,261	1,143	1,102	1,332	1,668	1,883	2,062
10,000 to 24,999.......		1,470	781	773	837	920	1,041	1,215	1,407	1,549	1,748	2,045	2,469	2,758
25,000 or more.........			1,962	2,127	2,421	2,644	2,829	2,994	3,045	3,614	3,594	4,193	5,502	5,864
	Company R&D funds per employee													
Total............	$470	$580	$818	$905	$1,040	$1,112	$1,233	$1,347	$1,487	$1,650	$1,764	$2,059	$2,534	$2,795
Less than 1,000........	360	420	579	580	657	810	893	879	933	956	1,176	1,333	1,381	1,745
1,000 to 4,999.........	340	370	525	540	572	642	699	790	841	910	1,108	1,311	1,503	1,832
5,000 to 9,999.........	520	420	609	663	729	749	921	1,004	989	987	1,048	1,323	1,551	1,691
10,000 to 24,999.......		660	557	598	688	791	842	927	1,077	1,237	1,414	1,675	2,025	2,245
25,000 or more.........			1,059	1,204	1,432	1,519	1,651	1,781	1,873	2,271	2,273	2,641	3,436	3,645

Note: Averages were derived by dividing total and company R&D funds for a calendar year by employment figures for March of that year.

SOURCE: National Science Foundation.

Section C
Reproduction of Survey Instruments

Page

National Science Foundation covering letters 70
Bureau of the Census covering letter for Form RD-1......... 74
Bureau of the Census covering letter for Form RD-1A........ 75
Instructions... 77
Form RD-1.. 87
Form RD-1A... 91
Form MA-121.. 93

NATIONAL SCIENCE FOUNDATION
WASHINGTON D C 20550

nsf

OFFICE OF THE
DIRECTOR

RD-1 Letter

Dear Respondent:

The National Science Foundation requests your company's participation in its 1983 Survey of Industrial Research and Development by completing the enclosed questionnaire and returning it to the U.S. Bureau of the Census.

This survey is the only source of detailed information on U.S. industrial firms' performance of research and development, which accounts for nearly 70 percent of total U.S. R&D expenditures. Thus, it is important that data from every company are included so that the survey results will be accurate and complete. Enclosed are preliminary findings from the 1982 survey.

Approximately 3,500 persons representing industry, government, and the academic community receive the results of this R&D survey each year. In addition, the Foundation received nearly 500 requests for information from this survey last year; over one-third of these inquiries were from individuals employed by industry and trade associations. We have been informed that company personnel use the data in assessing and planning their own firms' R&D programs. About 150 requests were received from officials representing Federal agencies. The information provided by the survey is essential to governmental decision-makers responsible for evaluating this country's scientific research effort and for formulating effective public policies and programs to strengthen industry's role in scientific and technological innovation. Other inquiries were received from researchers at colleges and universities, from consultants (many working for companies), and from the press.

This year we are asking you to complete the biennial "long form" which was the standard annual form until 1978. In that year, we began to use a "short form" in alternate years in an attempt to lessen your reporting burden. Your response to the complete set of questions for 1983 is needed so that national time series data can be maintained and improved.

RD-1-L2 (12-8-83)

Your company's responses are kept confidential--the Foundation receives the data from the Census Bureau only after they have been aggregated by individual industries. Inquiries regarding the conduct of the survey should be directed to the U.S. Department of Commerce, Bureau of the Census, Industry Division, Washington, D. C. 20233.

We appreciate both your past and continuing participation in this survey. If you desire a copy of the published report or would like to offer a suggestion for improving any aspect of the survey, please contact Dr. Charles E. Falk, Division Director, Division of Science Resources Studies, Room L-602, National Science Foundation, Washington, D. C. 20550.

Sincerely yours,

Edward Knapp

Edward A. Knapp
Director

Enclosures

NATIONAL SCIENCE FOUNDATION
WASHINGTON D C 20550

nsf

OFFICE OF THE
DIRECTOR

RD-1A Letter

Dear Respondent:

The National Science Foundation requests your company's participation in its 1983 Survey of Industrial Research and Development by completing the enclosed questionnaire and returning it to the U.S. Bureau of the Census.

This survey is the only source of detailed information on U.S. industrial firms' performance of research and development, which accounts for nearly 70 percent of total U.S. R&D expenditures. Thus, it is important that data from every company are included so that the survey results will be accurate and complete. Enclosed are preliminary findings from the 1982 survey.

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Sincerely yours,

Edward Knapp
Edward A. Knapp
Director

Enclosures

RD-1-L1 (1983)
(10-12-83)

UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233

OFFICE OF THE DIRECTOR

January 6, 1984

RD-1 Letter

FROM THE ACTING DIRECTOR
BUREAU OF THE CENSUS

The Bureau of the Census conducts the "Survey of Industrial Research and Development" under sponsorship of the National Science Foundation. These measures of research and development expenditures by industry are important in analyzing and forecasting long-term economic growth, investigating productivity determinants, formulating tax policy recommendations, and comparing individual research performance against industry averages.

We are enclosing your report form and file copy for the "Survey of Industrial Research and Development During 1983" (RD-1). We also are enclosing an instruction manual to assist you in completing the report and a letter from the National Science Foundation, which sponsors this survey, describing the importance of the survey results.

To reduce response burden, we alternate between a "long" and a "short" form every other year. The "long" version is being used for 1983. This report form is basically unchanged from the 1981 version.

Please read the instruction manual carefully, since it provides guidelines for reporting. We recognize that book records for particular items may not be maintained. In such cases, carefully prepared estimates are acceptable.

This report is authorized by law (Title 13, United States Code). Items 2A and 2B and Columns 2 and 4 of Item 5C are part of the basic statistical program of the Bureau of the Census for manufacturing companies, and reporting of these items is mandatory. Response to the remainder of the inquiries is voluntary; however, your cooperation is needed to make the results of the survey comprehensive and accurate. By Section 9 of the same law (Title 13), your report to the Census Bureau is confidential. It will be seen only by sworn Census Bureau employees and used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

Requests for copies of the resulting publication or any questions concerning this survey should be directed to Mr. William Starr of our Industry Division on (301) 763–5598. We appreciate your past cooperation in this important survey and look forward to your continued participation.

Sincerely,

CLKincannon

C. L. KINCANNON

Enclosures

☆ U.S. GOVERNMENT PRINTING OFFICE 1983—759-009/123

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RESEARCH AND DEVELOPMENT
IN INDUSTRY,1983...
NATIONAL SCIENCE FOUNDATION

2 OF 2
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RD-1A-L1 (1983)
(9-30-83)

UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233

OFFICE OF THE DIRECTOR

RD-1A Letter

FROM THE ACTING DIRECTOR
BUREAU OF THE CENSUS

The Bureau of the Census conducts the "Survey of Industrial Research and Development" under sponsorship of the National Science Foundation. These measures of research and development expenditures by industry are important in analyzing and forecasting long-term economic growth, investigating productivity determinants, formulating tax policy recommendations, and comparing individual research performance against industry averages.

Under a contract with the National Science Foundation, we are surveying a supplemental panel for 1983. This panel includes the smaller research and development performers.

We have enclosed copies of Form RD-1A, "Survey of Industrial Research and Development During 1983," and a letter from the National Science Foundation that emphasizes the survey's importance. The 1983 report on Form RD-1A should cover your entire domestic company.

This report is authorized by law (Title 13, United States Code). Item 2 and Columns 2 and 4 of Item 4A are part of the basic statistical program of the Bureau of the Census for manufacturing companies, and reporting of these items is mandatory. Response to the remainder of the inquiries is voluntary; however, your cooperation is needed to make the results of the survey comprehensive and accurate. By Section 9 of the same law (Title 13), your report to the Census Bureau is confidential. It will be seen only by sworn Census Bureau employees and used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

We thank you for your cooperation in this survey. Requests for copies of the resulting publication or any questions concerning the survey should be directed to William Starr of our Industry Division on (301) 763–5598.

Sincerely,

Kincannon

C. L. KINCANNON

Enclosures

RD-1-F1
(12-6-83)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

COMPANIES' OWN R&D FUNDING ROSE 14% DURING 1982 DESPITE RECESSION

- A 14% current-dollar increase in companies' own funding of research and development (R&D) programs combined with a 2% drop in net sales to produce the largest single-year increase in the company R&D funds/net sales ratio in the 25-year history of this data series. Company funds as a percent of net sales, which has ranged between 2.0% and 2.2% for more than a decade, soared to 2.6% in 1982. Industry officials attribute this increase to a recognition of research and development as one of companies' principal sources for future growth and to the R&D incentives provided by the 1981 Economic Recovery Tax Act.

- Together, company and Federal funds for industry-performed research and development totaled nearly $60 billion, 15% above the 1981 level. In constant 1972 dollars, the increase was 8%, significantly higher than the 5.5% average annual growth rate registered between 1975 and 1981.

- Increased R&D contracts from the Department of Defense was the primary factor in the 16% rise (9% after adjustment for inflation) in Federal R&D funding of industrial research and development reported for 1982. Over one-half of the $19 billion received from Government sources went to companies in the aircraft and missiles industry, largely to develop military aircraft and advanced weapons systems.

- Energy-related research and development continued to decline relative to industry's total R&D expenditures, falling from a high of 10% in 1979 to 7% in 1982. R&D expenditures in this area remained at $4.2 billion for the third straight year.

- The increase in real R&D expenditures was accompanied by a comparable increase in the employment of R&D scientists and engineers. Their numbers, in full-time-equivalent terms, increased 7% in 1982 to 550,000, led by a 10% increase in aircraft and missiles firms.

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These data are based on preliminary findings from the 200 largest R&D-performing companies reporting in the 1982 Survey of Industrial Research and Development.

FORM **RD-1 (I)**
(8-31-83)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20233

INSTRUCTIONS FOR SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1983

Outline of instructions — Page

GENERAL

- Information about reporting: Additional forms . . . 2
- Companies new to survey . . . 2
- Preposted figures . . . 2
- Revision of figures . . . 2
- Coverage — reported unit, period, geographic area . . . 2

Section I — GENERAL COMPANY DATA . . . 2

- Item 2 — Sales and Employment for Company . . . 2

DEFINITION OF RESEARCH AND DEVELOPMENT . . . 2

Section II — RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES . . . 3

- Item 4 — Number of Research and Development Scientists and Engineers . . . 3
- Cost or Receipts for Research and Development Performed Within the Company by Source of Funds . . . 3
- Types of Research . . . 4
  - Item 5A — Basic Research . . . 4
  - Item 5B1 — Applied Research . . . 4
  - Item 5B2 — Development . . . 4
- Methods of Estimating Research and Development by Major Type . . . 4
- Source of Funds . . . 5
  - Item 5 — Column 2, Federal . . . 5
  - Item 5 — Column 3, Company and Other, except Federal . . . 5
  - Item 5E — Funds Budgeted for 1984 . . . 5
- Item 6 — Cost of Research and Development by Principal Federal Agency . . . 5
- Item 7 — Cost of Research and Development by Major Type of Expense . . . 5
- Item 8 — Fields of Basic Research . . . 6
- Item 9 — Applied Research and Development by Product Group . . . 6
- Item 10 — Costs of Research and Development Performed Within the Company by State . . . 8
- Item 11 — Research and Development by Functional Category . . . 8

Section III — REPORTING OF RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE OF COMPANY WITH COMPANY FUNDS . . . 9

- Item 12 — Total Company Funds Spent for Research and Development Activities Performed Outside the Company Within the United States . . . 9
- Item 13 — Total Company Funds Spent for Research and Development Activities Performed by Foreign Affiliates Outside the United States . . . 9

Section IV — RESEARCH AND DEVELOPMENT DISTRIBUTION BY SPECIAL CATEGORIES . . . 9

- Item 14 — Product Versus Process Applied Research and Development . . . 9
- Item 15 — Total Company Funds Expended on Government Regulations . . . 9
- Item 16 — Long- Versus Short-Term Research and Development Costs . . . 9

GENERAL

Information About Reporting: Additional Forms — Reporting on this form may require that companies resort to the use of estimates in answering some of the questions. We are satisfied, however, that the comparability of data among companies with research and development programs is sufficient to develop meaningful totals and measures of changes from year to year.

If you require additional copies of the form, write to the Bureau of the Census, 1201 East Tenth Street, Jeffersonville, Indiana 47132. If you have any questions regarding reporting of this form, write to the Bureau of the Census, ATTN: Industry Division, Washington, D.C. 20233, or call (301) 763—5598.

Companies Reporting in Survey for the First Time — Companies not reporting in the 1982 survey should fill in the figures for both year. If the company had no expenditures for research and development, complete only "Item 2." Enter "No R&D" in the space for remarks on page 2 of the form, sign, and return the form.

Figures for Earlier Years are Preposted on the Form — If your company reported on form RD-1 for 1982 certain figures from that form have been copied to the present form. Please describe in the "Remarks" section (page 3 of the form) the reasons for any substantial increases or decreases in the 1983 figures entered on this form when compared to corresponding 1982 figures. Examples of such reasons are new government contracts, acquisitions, and disposals, revised accounting method, etc. If you acquired or disposed of a unit performing an important amount of research and development during the 2-year period, please identify the unit in remarks, and give the total amount of research and development accounted for by such unit.

Revision of Earlier Year Figures — The 1982 figures should be revised if necessary to assure comparability with 1983 data. Please explain in remarks, any significant change in the 1982 figures. If your company did not report for 1982, fill in the figures for both years; however make no entry for items which were not on the original 1982 report form (dark shaded).

Report for Your Entire Company — Research and development activities for your entire domestic company should be reported, including all subsidiaries and divisions of the company. If you desire to have subsidiaries report separately, please write to the Bureau of the Census and list your subsidiaries.

Period Covered by Report — The figures reported should cover the calendar year if at all possible. However, fiscal year data are acceptable for all items except employment, provided your fiscal year ends between September and March. Please report employment figures (item 2B and 4) for the period identified in each of the items mentioned.

Geographic Area Covered — The data are intended to relate to business firms in the fields of manufacturing, minerals, and other economic areas which operate one or more establishments in one or more of the 50 States or the District of Columbia.

▶ Section I — GENERAL COMPANY DATA

▶ **Item 2 — Sales and Employment for Company** — In item 2A, report the net sales and receipts of this company and its subsidiaries to customers outside the company. (Exclude domestic intra-company transfers and sales by foreign subsidiaries; however, include transfers to such foreign subsidiaries and export sales to foreign companies.) The reported figures should represent value f.o.b. plant after discounts and allowances and should not include freight charges; excise taxes should be excluded. In item 2B report the number of persons employed at the company in all activities in the 50 States or the District of Columbia during the pay period which includes the 12th of March 1982 and 1983. This figure would be the same as that shown by the company in item 1 of Treasury Form 941, if the company filed one form 941 for the entire company.

DEFINITION OF RESEARCH AND DEVELOPMENT

Research and development includes basic and applied research in the sciences and in engineering, and design and development of prototype products and processes. For the purposes of this questionnaire, research and development includes activities carried on by persons trained, either formally or by experience, in the physical sciences including related engineering, and the biological sciences including medicine but excluding psychology, if the purpose of such activity is to do one or more of the following things:

1. Pursue a planned search for new knowledge, whether or not the search has reference to a specific application.

2. Apply existing knowledge to problems involved in the creation of a new product or process, including work required to evaluate possible uses.

3. Apply existing knowledge to problems involved in the improvement of a present product or process.

Research and development includes the activities described above whether assigned to separate research and development organizational units of the company or carried on by company laboratories and technical groups not part of a research and development organization. We recognize that the reporting activities of such latter groups will require the use of estimates for some of the questions.

Activities to be Excluded From Research and Development — Research and development for purposes of this survey does not include quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, or other nontechnological activities or technical services.

More specifically, exclude from research and development such nontechnological activities as market research, including statistical surveys of product acceptance, estimates of market size, and studies of channels of distribution; and market development, including the sale of either old or new products to obtain acceptance of them in new outlets; economic research and other research in the social sciences; and legal work in connection with patent applications and litigation, and the sale of licensing of patents.

Also exclude from research and development such technical services as: quality and quantity control tests and analyses, troubleshooting in connection with breakdowns in full-scale production, including related analytical work; technical plant sanitation control; work required for minor adaptations of a specific product to meet the requirements of a specific customer, including installation and servicing in a customer's plant; engineering and other technical service furnished in accordance with agreements to licensees outside the company; aid furnished by the research and development organization to manufacturing divisions to enable them to operate in accordance with previously determined formulas, standard practice instructions, or finished product specifications; aid furnished to develop advertising programs and to promote or demonstrate new products or processes, including the cost of material furnished for trial or demonstration; assistance in preparation of speeches and publications for persons not engaged in research and development; and experimental work performed at the request of the patent division to provide information needed during the prosecution of a patent litigation.

▶ Section II — RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES

▶ **Item 4 — Research and Development Scientists and Engineers** — Scientists and engineers for this survey are defined as all persons engaged in scientific or engineering work at a level which requires a knowledge of physical or life sciences or engineering or mathematics, equivalent at least to that acquired through completion of a four-year college course with a major in these fields, regardless of whether they held a college degree in the field.

As in the past, the figure on R&D scientists and engineers will be obtained primarily from two sources:

1. Records on the number of scientists and engineers assigned to research and development. This source is satisfactory so long as the scientists and engineers of the unit are assigned to research and development on a full-time basis (i.e., no more than 5 percent of their time is spent on nonresearch and development). For example, for company laboratories performing only research and development, report the number of scientists and engineers on the rolls in January. For other units, use source 2.

2. Figures on the proportion of total work time of scientists and engineers that is devoted to research and development. For example, if the engineering department of a manufacturing plant had 60 scientists and engineers in January 1983 and one-fourth of the scientists' and engineers' time during that month was charged to research and development projects, the figure for the number of research and development scientists and engineers included for that unit would be 15.

Separate figures are requested on the number of scientists and engineers working on Federal and company and other research and development projects. Where research and development work for the Government and for the company is performed by the same group of scientists and engineers, it will be necessary to distribute the total number of such scientists and engineers according to the program, Federal or company, for which the research and development work was performed; i.e., to use the proportion of the total work time of research and development scientists and engineers that is devoted to Federal and company research and development programs, in order to distribute the total reported in item 4C. The resulting figures should be reported to the nearest work-year, in order to present a reasonable division of time assigned to Federal and company and other research and development programs.

Please divide the requested figures into the related cost figures and check the resulting cost figure of research and development per scientist and engineer for reasonableness.

Cost or Receipts for Research and Development Performed Within the Company by Major Type and Source of Funds — Include all costs incurred to support research and development, exclusive of capital expenditures, but including depreciation and overhead. If you perform research and development for others on contract, include the total charged for the work performed, including profit.

The relevant costs usually include but are not limited to the elements listed below:

1. Wages, salaries, and related costs. Material and supplies consumed (or purchased, if consumption figures are not available); utilities, such as telephone, telex, electricity, water, gas, and fuel; books and periodicals; travel and entertainment costs and professional dues.

2. Property taxes and other taxes (except income taxes) incurred on account of the research and development organization or on the facilities which the research and development organization uses. Insurance expense. Maintenance and repair, including the maintenance of buildings and grounds, depreciation on buildings, equipment, and vehicles; or rentals, if any facilities are leased.

3. Company overhead. Estimate a fair share of the cost of any functions which support research and development activities. The basis and method of estimating overhead costs will depend upon company practice. The important point is to be sure that all companies include an allowance for overhead. Items normally covered in overhead include the following:

Personnel, including personnel, medical and safety departments, and employee or industrial relations department; accounting control and fiscal (Treasurer's office); procurement and inventory, including purchasing, receiving, inspection, storage, transportation, control, and issue of materials and supplies; other services, including legal, public relations, shopwork, analytical work, plant protection, rearrangement of facilities, drafting, printing, duplicating, transportation of material and personnel, maintenance of motor vehicles, messenger service, stenographic service, and photography; salaries and related costs of research executives not on the payroll of the research and development organization.

Do not net your research and development expenditures by the amount of royalties received from either non-company organizations or company units; or the credits received for research and development work charged or "sold" to other departments or divisions of reporting company or to outside organizations.

Types of Expense to be Excluded From Research and Development Costs — Exclude from the cost of research and development performed within the company the cost of research and development carried on for the company by noncompany research and development organizations of any kind; or fellowships, grants, and gifts to promote research and development or the study of the sciences and engineering. That part of company-held research and development contracts subcontracted to research and development organizations outside reporting company. All work that was done for your laboratories and other technical units by noncompany organizations which are not research and development organizations (for example, model construction by a noncompany model shop) is to be considered as a purchase of equipment, material, or supplies for the company research organization rather than as subcontracted research and development.

Also exclude capital expenditures, royalties paid, patent expense, income taxes, or interest. Income from sale of products manufactured in the research and development organization if these were sold to bona fide customers.

▶ Item 5 — Research and Development Performed Within the Company by Type and by Source of Funds

This item provides separate columns for reporting in 1983 the costs of research and development in Federal contracts and subcontracts, and Company and Other research and development by the three types; basic, applied, and development. Definitions of "Federal," and of "Company and Other" are provided below, after the definitions of types of methods for estimating the breakdowns by type.

Types of Research — Breakdown the total reported in item 5 into the categories shown below:

Item 5A — Basic Research — Include the cost of research projects which represent original investigation for the advancement of scientific knowledge and which do not have specific commercial objectives, although they may be in the fields of present or potential interest to the reporting company.

Item 5B1 — Applied Research — Include the cost of research projects which represent investigation directed to discovery of new scientific knowledge and which have specific commercial objectives with respect to either products or processes. **Note that this definition of applied research differs from the definition of basic research chiefly in terms of the objectives of the reporting company.**

Item 5B2 — Development — Include the cost of projects which represent technical activity concerned with nonroutine problems which are encountered in translating research findings or other general scientific knowledge into products or processes. Do not include routine technical services to customers or other items excluded from definition or research-development above.

Methods of Estimating Research and Development Expenditures by Type — Many of the companies in this survey have accounts they believe substantially meet the definitions used in this survey for basic research, applied research, and development. In most cases, companies have found it possible to allocate their own accounts to these categories.

If your company does not keep records that meet or can be allocated to these specific categories, there are two principal ways to reduce the task of poviding the data requested.

1. Isolate the projects that clearly fall in the development category. If your company fabricates products, such development activity will include the design, construction, and testing of prototypes and models. Some defense contracts typically call for several test models. If your company's research and development frequently involves the development of a "process" as in chemicals and petroleum, such development activity would include operations beyond the bench scale, primarily the design and operations of pilot plants or semiworks.

2. Isolate the organizational units which have research and development activities that can be readily classified. If a company has two or more laboratories, the expenditures of some of these laboratories may be all classified in one or another type of research and development on the basis of the function assigned to the laboratory. There are laboratories assigned only development type work. There are others engaged only in applied or basic research. If research and development work is done in production units as well as in various laboratories, the research and development work in the production units will generally be of a development type.

The separate classification of clearly identified development operations, particularly in the industries producing expensive prototypes, will greatly reduce the balance to be distributed. The distribution will have to be estimated on the basis of a review of individual projects or on the basis of other summaries of the work. Please use the definitions for basic, applied, and development, as given above. If, despite these instructions, you feel that you are unable to distribute your research and development expenditures into groupings approximating the categories requested, please write to the Bureau of the Census describing your accounts and indicating your special problems.

The Bureau may be able to make or obtain some suggestions that will be helpful in completing the report form.

Types of Activity Included in Development — The design and operation of pilot plants or semi-works plants so long as the principal purposes are to obtain experience and to compile engineering and other data to be used in evaluating hypotheses, in writing product formulas or in establishing finished product specifications, in designing special equipment and structures requird by a process, and in preparing operating instructions or manuals. The engineering activity required to advance the design of a product or a process to the point where is meets specific functional and economic requirments and can be turned over to manufacturing units. The design, construction, and testing of preproduction prototypes and models and "engineering follow-thorugh" in the early production phase is included.

The development of designs for special manufacturing equipment and tools is included but toolmaking and tool tryout are not included. The preparation of reports, drawings, formulas, specifications, standard practice instructions or operating manuals, and other media for transmitting to operating units information obtained from the above activities is included. However, the production of detailed construction drawings or manufacturing blueprints is not included.

The question, "When does development end and production begin?" is often asked. If the primary objective is to make further improvements on the products or process, then the work comes within the definition of research and development. If, on the other hand, the product or process is substantially "set," and the primary objective is to develop markets or to do preproduction planning, or to get the production process going smoothly, then the work is no longer research and development.

Source of Funds — A separate column in item 5 is provided for each of the following:

Item 5, Column 2 — Federal — Include the cost of work done on research and development contracts or subcontracts, and research and development portions of procurement contracts and subcontracts during the year.

Do not include here, or elsewhere in the report, research and development contracts and the portions of procurement contracts that you subcontracted to other research and development organizations. To do so would cause duplication in the statistical totals derived from these reports.

Item 5, Column 3 — Company and Other — Include the cost of all company-sponsored research and development performed within the company. (Report company-sponsored research and development performed outside the company in item 12.) Research and development is performed by a few manufacturing companies for others than the Federal Government. Such research and development should be included in this column.

In item 5E, report the expected or estimated cost of company-sponsored research and development that will be performed within the company during 1984.

▶ **Item 6 — Cost of Research and Development by Principal Federal Agency. Distribute the Cost of Federal Research and Development Work (item 5c, column 2 of form RD-1) by Federal Agency** — Companies reporting Federal research and development are asked to provide separate figures for the four categories of Federal agencies: Department of Defense, National Aeronautics and Space Administration, Department of Energy, and all other Federal agencies. In general, most companies performing large amounts of research and development for the Government will have one or more separate organizational units charged with responsibility for most Federal contracts. Reporting of the requested data has been simplified for some companies by using the data available from the accounts of such units as the basis for the overall company figures on the number of scientists and engineers and the costs of Federal programs. For example, if 80 percent of the work for Federal agencies is performed by units with separate accounts, it should be reasonable to estimate the company totals on the basis of such figures rather than make special tabulations or separate estimates for each of the company units that may be doing some work on government research and development.

▶ **Item 7 — Cost or Contract Value of Research and Development Performed Within the Company by Major Type of Expense** — The type of information requested here will be available for separate research and development organizational units or for companies with separate research and development accounts. It is not requested that special analyses be made of cost records where research and development and other functions are combined and if existing records do not yield estimates for this item, the item need not be completed. However, if most research and development is performed in units where summaries are regularly prepared by element of cost it should be possible to base the breakdown of research and development costs upon the records of such establishments.

For wages and salaries report the gross earnings paid in calendar year 1983 to employees engaged in research and development, including dismissal pay, paid bonuses, vacation and sick-leave pay, and compensation in kind, and prior to such deductions as employees' Social Security contributions, withholding taxes, group insurance, and savings bonds. (You should follow the definition of salaries and wages that is used for calculating the withholding tax.) Include salaries of officers in the research establishment(s). If a corporation; exclude payments to proprietor or partners, if an unincorporated concern. Exclude payments to members of armed forces and pensioners carried on your active payroll. (Scientists and engineers are defined on page 3, item 4.)

For materials and supplies, report the delivered cost for all purchased materials consumed, whether received from other companies, withdrawn from inventory, or received from other establishments of this company.

Item 7B — Materials and Supplies, and Item 7C — Other Costs may be combined if a separate figure cannot be obtained or reasonably estimated from present accounts.

▶ **Item 8 — Fields of Basic Research** — The following definitions are supplied for fields included in the item:

Engineering — Includes aeronautical, astronautical, chemical, civil, electrical, and mechanical engineering, and metallurgy and materials.

Geological sciences — Includes geodesy, hydrology, geochemistry, seismology, soil sciences, etc.

Atmospheric sciences — Includes aeronomy, weather modification, meteorology, etc.

Biological sciences — All sciences, other than clinical medical sciences, which deal with life processes, including plant and animal sciences, bacteriology, pathology, microbiology, pharmacology, etc.

Clinical medical sciences — All sciences concerned with the use of scientific knowledge for the identification, treatment, and cure of disease. Includes internal medicine, neurology, preventive medicine and public health, psychiatry, dentistry, pharmacy, etc.

Other sciences — To be used for multidisciplinary and interdisciplinary projects which cannot be classified within one of the above primary fields of science.

▶ **Item 9 — Applied Research and Development by Product Group** — Enter both Federal and total costs of Applied Research and Development by product group. Costs should be entered in the field or product group in which the research and development project was actually carried on regardless of the classification of the field of manufacturing in which the results are to be used. For example, research on an electrical component for a farm machine should be reported as research on electrical machinery. Also, research on refractory bricks to be used by the steel industry should be reported as research on stone, clay, glass, and concrete products rather than primary ferrous metals, whether performed in the steel industry or the stone, clay, glass, and concrete industry.

Research and development work on an automotive head lamp would be classified in group 25, regardless of whether performed by an automotive or electrical company. Fields of Applied Research and Development are listed below. For those companies familiar with the Standard Industrial Classification, the 1972 SIC number or numbers are given after each title. Note, however, that the SIC definition here applies to the field of research and development effort, and not necessarily to the field in which your company's manufacturing output is classified.

Product Group

1. **Atomic Energy Devices** — Applied Research and Development on atomic energy devices should be included with research and development as classified in the categories listed on lines 2—33. Examples of the fields of research and development activities on atomic energy devices and the product groups in which such activities should be reported are as follows:

Activity	Product Group No.
Radioactive isotopes and other radiation sources	4
Partially fabricated reactor fuel element materials and control rods	12
Nuclear reactors	14
Reactor components and equipment	
Core structurals (barrels, cans, boxes, plates, etc.)	
Heat exchangers and condensers	
Valves	
Complete reactor fuel elements and control rods for use in:	
Propulsion	
Power plants	
Other	
Atomic waste casks	
Fuel handling equipment	20
Control rod drive mechanism and components for:	
Power plants	
Propulsion	
Other	
Pressurizers, components, and auxiliary equipment	
Pumps	
Accessory instrumentation for reactor control	22
Atom smashers (particle accelerators)	24
Hot laboratory equipment	31
Special instrumentation	

2. **Foods and Kindred Products (SIC 20)** — Foods and beverages for human consumption and certain related products, such as vegetable and animal fats and oils, prepared feeds for animals and fowls.

3. **Textile Mill Products (SIC 22)** — Mill preparation of fibers and mill manufacture of yarn, thread, braids, twine, and cordage; manufacture of broad and narrow woven fabric, knit fabric, carpets and rugs from yarn; dyeing and finishing fiber, yarn, and knit apparel; coating, waterproofing, or otherwise treating fabric; the integrated manufacture of knit apparel; and other finished articles from yarn; the manufacture of felt goods, lace goods, bonded fiber fabrics, and miscellaneous textiles.

4. **Basic Industrial Inorganic and Organic Chemicals (SIC 281 and 286)** — Includes radioactive isotopes and other radiation sources.

5. **Plastics Materials and Synthetic Resins, Synthetic Rubber, Synthetic and Other Manmade Fibers Except Glass (SIC 282)** — Exclude glass.

6. **Drugs (SIC 283)** — Medicinal chemicals, biological and botanical products, and pharmaceutical preparations.

7. **Agricultural Chemicals (SIC 287)** — Fertilizers, agricultural pesticides, and other agricultural chemicals.

8. All Other Chemicals (balance of SIC 28) — Explosives, soaps, glycerins, detergents and cleaning preparations, paints and varnishes, toilet preparations, and miscellaneous chemical products.

9. Petroleum Refining and Extraction, and Natural Gas (SIC 13 and 29) — Exclude geological and geophysical exploration activities.

10. Rubber and Miscellaneous Plastics Products (SIC 30) — Fabricated rubber such as industrial and mechanical rubber goods and fabricated plastics products.

11. Stone, Clay, Glass, and Concrete Products (SIC 32) — Ceramics, glass, clay products, abrasives and asbestos products, cement, stone products, concrete products, and other nonmetallic mineral products.

12. Primary Ferrous Products (SIC 331, 332, 3462, and 3399) — Products of blast furnaces, steel works, rolling and finishing mills, iron and steel castings and forgings. Includes partially fabricated reactor fuel element materials and control rods.

13. Primary and Secondary Nonferrous Metals (balance of SIC 33 and 3463) — Primary and secondary smelting and refining of nonferrous metals; rolled, drawn, and extruded nonferrous metal products, castings and forgings.

14. Fabricated Metal Products (SIC 34 except 3462, 3463, and 348) — Tinware, hand tools, nonelectric heating apparatus, fabricated structural metal products, metal stampings, fabricated wire products, etc. Includes: nuclear reactors; reactor components and equipment; core structurals (barrels, cans, boxes, plates, etc.); heat exchangers and condensers; valves; complete reactor fuel elements and control rods for use in: propulsions, power plants, and other systems; atomic waste casks.

15. Engines and Turbines (SIC 351) — Steam engines, steam, gas and hydraulic turbines, diesel and other internal combustion engines, n.e.c.

16. Farm and Garden Machinery and Equipment (SIC 352) — Farm machinery, including tractors for farm use.

17. Construction, Mining, and Material Handling Machinery and Equipment (SIC 353) — Construction, mining, and oil field machinery and equipment, elevators, conveyors, hoists, industrial trucks, tractors, trailers, and stackers.

18. Metalworking Machinery and Equipment (SIC 354) — Machine tools, dies, machine tool accessories, rolling mill machinery, power driven hand tools, wire fabricating machinery and equipment, and automobile maintenance machinery and equipment.

19. Office, Computing, and Accounting Machines (SIC 357) — Typewriters; electronic computing equipment; calculating and accounting machines; scales and balances (except laboratory); and other computing and office machines.

20. Other Machinery, Except Electrical (balance of SIC 35) — Special industrial machinery, except metalworking, such as food products machinery, textile and paper industries machinery, general industrial machinery and equipment, and miscellaneous machinery except electrical. Includes atomic fuel handling equipment; control rod drive machanism and components for: power plant, propulsions; pressurizers. components and auxiliary equipment; pumps.

21. Electric Transmission and Distribution Equipment (SIC 361 and 3825) — Electric measuring instruments and test equipment, power, distribution and specialty transformers, switchgear and switchboard transformers, etc.

22. Electrical Industrial Apparatus (SIC 362) — Electric motors and generators, motor starters and controls, welding apparatus, carbon and graphite brushes, electrodes, capacitors, condensors, and rectifiers. Includes accessory instrumentation for reactor control.

23. Radio and Television Receiving Sets, Except Communication Types (SIC 365) — Radio and television receiving sets, except communication types and phonograph records.

24. Electronic Components and Accessories, Communications Equipment (SIC 366—67) — Electron tubes,cathode ray tubes, resistors-capacitors, transformers and other components for electronic and products, solid state electronic devices, and telephone and telegraph apparatus. Also includes electronic guidance control subassemblies, radar and radio equipment, and electronic sighting devices. Includes atom smashers (particle accelerators).

25. Other Electrical Machinery Equipment and Supplies (balance of SIC 36) — Household appliances, electric lighting and wiring equipment, and miscellaneous electrical machinery equipment and supplies.

26. Missiles (SIC 376) — Including frames or structures, launching and handling support equipment and work on the missile system as a whole. Electronic guidance control subassemblies and radar should be included in group 24 above. Rocket motors should be included in group 28 below.

27. Space Vehicles (SIC 376) — Including frames or structures, launching and handling support equipment and work on the space vehicle as a whole.

28. Aircraft and Parts (SIC 372) — Piloted and unpiloted aircraft and parts of all types, including engines and auxiliary equipment such as landing gear, deicing equipment, and other auxiliary equipment specifically adopted for aircraft. Radar and radio equipment and electronic sighting devices should be included in group 24 above. Aeronautical instruments should be included in group 31 below.

29. Motor Vehicles and Equipment (SIC 371) — Applied research and development related to motor vehicles, including automobiles, trucks, busses, and special purpose motor vehicles such as ambulances, fire engines, personnel carriers, amphibian motor vehicles, and truck and automobile trailers, and to motor vehicle equipment and parts (exclude batteries, tires, engine electrical equipment, etc.)

30. Other Transportation Equipment (balance of SIC 37) — Shipbuilding, boatbuilding, and repairing, railroad equipment, motorcycles, bicycles, and parts, etc.

31. Measuring, Analyzing, and Controlling Instruments, Photographic, Medical and Optical Goods; Watches and Clocks (SIC 38 except 3825) — Engineering, laboratory, and scientific and research instruments, instruments for measuring, controlling, and indicating physical characteristics. Optical instruments and lenses, surgical, medical, and dental instruments; fire control apparatus; ophthalmic goods, photographic equipment; and watches, clocks, etc. Includes hot laboratory eqipment, and special instrumentation.

32. Ordnance, Except Missiles (SIC 348, 3795) — Artillery, small arms, ammunition, tanks, and parts, etc.

▶ **Item 10 — Cost of Research and Development Performed Within the Company, by State** — List the States in which your research and development laboratories or facilities are located and report the cost of research and development for each State. It is not intended that information reported reflect individual assignments outside the home State of the particular research staff. As much as 10 percent of the total may, if desired, be reported as "Not distributed by State."

▶ **Item 11 — Research and Development by Functional Category**

Energy Research and Development — Include all R&D spending whose purpose is to increase energy resources or capabilities, including the development of energy equipment. Some R&D spending is for joint or multiple purposes. In these instances, estimate and report the portion of cost incurred due to the energy purpose. Energy R&D can include costs of R&D projects (both product and process) on exploration, extraction transportation, processing, storage, generation (including conversion), distribution, conservation, etc., of present, new, or improved forms of energy. Record energy R&D spending according to type of energy.

Coal R&D activities are to be assigned into three subcategories. **"Synthetic fuels"** includes programs designed to convert coal to gaseous and liquid products. **"Mining"** is composed of programs for developing equipment and techniques to improve the productivity and recovery rates of coal mining.

"Conservation and utilization" includes R&D activities undertaken to reduce consumption either at the point of energy use or in the transmission, transportation, storage, and conversion of energy. Examples of such are R&D undertaken primarily to reduce fuel consumption in manufacturing, to improve the efficency of transportation of energy products, or to produce an end product which is more efficient in energy consumption.

"All other energy" includes areas such as wind, waste, hydroelectric, etc. Also include in this category, (F), the development of energy equipment which cannot be readily classified in A to E. If the energy source is waste or any other area with pollution abatement aspects, consider carefully whether one of the purposes of the project is pollution abatement.

In a limited number of cases, the separation of joint (multiple) costs which is encouraged in the preceding paragraph may not be feasible. In this circumstance, include total project cost if the primary purpose of a project is energy R&D; do not include any of project cost if the primary purpose of the project is other than energy R&D.

Pollution Abatement Research and Development -- Pollution abatement R&D spending for the purpose of reducing or eliminating the emission of pollutants. As used here, abatement includes prevention, treatment, or recycling; pollution refers to the emission of pollutants to the outside of a firm's (or household's) property or activities. Do not include R&D spending to contribute to environmental aesthetics, to increase equipment durability in corrosive environments, to conserve energy (include as energy R&D) and natural resources, or to increase employee comfort, safety, and health.

There can be two types of pollution abatement R&D spending. In some cases, the only purpose of the R&D spending is pollution abatement. Examples are spending on projects to improve or design alternatives to electrostatic precipitators, wet scrubber systems, waste treatment systems, effluent monitoring devices, etc. In such cases, include the total expenditures on the R&D project. In other cases, pollution abatement is one of several purposes. Examples are spending on projects to improve production processes or products and simultaneously reduce the emission of pollutants. Pollution abatement purposes could also be combined with other types of environmental control purposes such as energy conservation or employee safety and health. In all these instances, estimate and report only the portion of cost incurred due to the pollution abatement purpose.

In a limited number of cases, the separation of joint costs which is encouraged in the preceding paragraph may not be feasible. In this circumstance, do not include any of project cost unless the primary purpose of the project is pollution abatement. When the primary purpose is pollution abatement, include the total cost in your answer.

Do not include any of project cost as being for pollution abatement if expected pollution abatement benefits are incidental. Incidental benefits are those obtained at no extra cost.

Show R&D spending according to the form of pollution being abated. For example, "air" has three subcategories, automotive emissions, electric power plant emissions, and all other, are included under "air." Automotive emissions includes all R&D efforts undertaken to reduce exhaust emissions from automobiles. Electric power plant emissions includes efforts directed toward reducing airborne emissions from electric power plants. All other includes efforts directed at removing sulfur oxide, nitrogen oxides and particulates, and other fossil-fuel pollutants from the atmosphere. Water should include R&D spending on water recirculation or thermal pollution abatement. R&D spending on waste compacting devices should be included under "solid waste," and R&D spending on noise and radiation pollution abatement should be included under "other."

Section III — RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE THE COMPANY — (R&D not included in item 5)

Item 12 — Total Company Funds Spent for Research and Development Activities Performed Outside the Company Within the United States — Report the amount of company funds spent for research and development performed outside of the company within the United States. This item includes contracts to outside organizations, but specifically excludes subcontracting of Federal Government or other company contracts.

Item 13 — Total Company Funds Spent for Research and Development Activities Performed by Foreign Affiliates Outside the United States — Report the amount of research and development financed by the U.S. parent or its foreign affiliates performed in R&D laboratories, branch plants, divisions, and subsidiaries located outside the United States.

This item excludes R&D activities performed in foreign affiliates financed by foreign governments or other outside organizations.

NOTE: Foreign affiliates are those outside the 50 States or the District of Columbia.

Section IV — RESEARCH AND DEVELOPMENT DISTRIBUTION BY SPECIAL CATEGORIES

Item 14 — Product Versus Process Applied Research and Development — Allocate the total applied research and development dollar figures of item 5B3, columns 2 and 3 ("FEDERAL" and "COMPANY") to either **product** or **process** research and development, items A and B below. If you are unsure whether the research and development is for a **process** or a **product**, refer to the definitions for each item below. If the expenditures are unclassifiable as **product** or **process**, enter the cost of such research in the **unclassifiable**, item C. Include in your allocation to **product**, **process**, or **unclassifiable** categories, any company overhead associated with the applied research and development that was included in the dollar figures of item 5B3.

Item A — Product Applied Research and Development Costs — Costs for applied research and development oriented towards goods that have the potential for sale to the public or to other firms. If the research and development cost is for your own "process" (see item B), but clearly involves making a product feasible, or is an integral part of product modification, rather than affecting the efficiency with which it is made (e.g., the scale-up of a chemical compound or the development of a completely new manufacturing technology), then it should be classified as a product research and development cost.

Item B — Process Applied Research and Development Costs — Costs for applied research and development devoted to reducing costs or increasing output by improvements in the manufacturing process.

Item C — Unclassifiable Applied Research and Development Costs — Applied research and development costs which you are not able to classify as product or process, based upon the above definitions.

Company overhead costs included in item 5B3 and related to projects which can be classified by product or process should be included in items A and B below and NOT in item C.

Item D — Total — Add together the totals for items A, B, and C for each year separately and enter amounts in the appropriate columns.

Item 15 — Total Company Funds Expended on Government Regulations — Allocate total company funds (exclude Federal) spent for research and development activities performed to meet the present regulations of the Federal agencies listed and which would not have been performed in the absence of these regulations.

Include expenditures to meet government regulations which have been established but which have a future compliance date. Exclude expenditures to meet anticipated government regulations.

Item 16 — Long- Versus Short-Term Research and Development Costs — Allocate the total R&D dollar figures of item 5C columns 2 and 3 ("FEDERAL" and "COMPANY"), based on the actual or estimated future life of each of your projects in the R&D cycle, into the following three categories:

Item A — Less Than or Equal to 2-Year Project Life — Include the current year's cost for all projects whose total life in the R&D cycle is expected to be less than or equal to 2 years from inception to completion or termination. Completion refers to the R&D phase only. At the time production planning, design, and engineering begins, R&D is usually over.

A distinction should be made between continuing programs and specific projects. While programs in broad areas may continue for long periods of time, you are asked to treat **specific projects with separate budgets**, definable goals, and project lives, except where projects are sequential, one depending on the other to reach a specified goal. Then you should treat the sequence as a single project.

Item B — 2- to 5-Year Project Life — Include the current year cost of all projects whose total life in the R&D cycle has been or is expected to be more than 2 years but less than or equal to 5 years.

Item C — More Than 5-Year Project Life — Include the current year cost of all projects whose total life in the R&D cycle has been or is expected to be more than 5 years.

Company overhead or other costs included in item 5C should be allocated to items A, B, or C below. The sum of A, B, and C should be equal to item 5C.

Please indicate by marking the appropriate boxes in column e whether the proportion of company funds for **Items A, B, and C have been** increasing, decreasing, or have remained about the same during the last 5-year period.

★U.S. GOVERNMENT PRINTING OFFICE: 1983—659-038/32

DUE DATE: 60 DAYS AFTER RECEIPT OF FORM O.M.B. No. 3145-0027: Approval Expires July 31, 1984

FORM **RD-1**
(9-30-83)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1983

RETURN TO
Bureau of the Census
1201 East Tenth Street
Jeffersonville, Indiana 47132

Name of person who supplied 1982 data

NOTE: Data supplied in items 2A and 2B and in item 5C, columns 2 and 4, for 1983 on this form, will satisfy the **mandatory** reporting requirement of Census Form MA-121 (title 13, U.S. Code). Although you are not required to complete the other items, your cooperation on these voluntary items is needed to make the results of this survey comprehensive, accurate, and timely.

NOTICE – Your report to the Census Bureau is **confidential** by law (title 13, U.S. Code). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are **immune from legal process.**

Item 1 – NAME AND ADDRESS OF COMPANY *(Please correct any error in name and address, including ZIP code)*

Group	Survey
4	4001

YOUR FILE COPY

CENSUS USE ONLY	1	2	3	4	5	6

GENERAL INSTRUCTIONS

- Please complete and return this form in the envelope provided within 60 days. Retain the file copy for your records. This report should cover your entire company including all subsidiaries and affiliates, unless otherwise designated.
- Enter "None" where appropriate rather than leaving a blank space.
- Reasonably accurate estimates are acceptable.
- Be sure 1982 and 1983 figures are comparable.

PLEASE READ ENCLOSED INSTRUCTIONS BEFORE COMPLETING THIS FORM

Section I – GENERAL COMPANY DATA

Item 2 – DOMESTIC SALES, RECEIPTS, AND EMPLOYMENT FOR COMPANY	CT1	1982 1	1983 2
A. Domestic net sales and receipts of this company *(Thousands of dollars)*	2001	$	$
B. Total domestic company employment in all activities during the pay period which includes the 12th of March 1982 and 1983	2002		

Item 3 – RESEARCH AND DEVELOPMENT EXPENDITURES

Are research and development expenditures for entire domestic company, including subsidiaries and affiliates, reported on this form? ☐ YES ☐ NO – *Please explain in remarks or on transmittal letter.*

Section II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES

(Exclude R&D financed by the company but performed by others. Report such R&D in section III.)

Item 4 – NUMBER OF RESEARCH AND DEVELOPMENT SCIENTISTS AND ENGINEERS *(See Instruction Manual, page 2)*	CT2	January 1983 1	January 1984 2
A. Federal research and development	3001		
B. Company and other research and development	3002		
C. TOTAL *(Sum of A and B)* →	3099		

Item 5 – COST OR RECEIPTS FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY BY MAJOR TYPE AND SOURCE OF FUNDS		CT2	*Thousands of dollars*			
			1983			
			1	Federal funds 2	Company and other funds, except Federal 3	TOTAL *(Sum of columns 2 and 3)* 4
A. Basic research *If "None," please mark* ☐ 35105		3510		$	$	$
B. Applied research and development	1. Applied research	3521				
	2. Development	3522				
	3. TOTAL *(Sum of lines 1 and 2)*	3529				
C. TOTALS *(Sum of A and B3)* →		3599				
D. 1982 TOTALS →		3598		$	$	$

	CT1	1	
E. Company and other funds, except Federal, budgeted for the year 1984 →	3800	$	

Item 6 – COST OF RESEARCH AND DEVELOPMENT BY PRINCIPAL FEDERAL AGENCY	CT1	*Thousands of dollars*	
		1	1983 2
Cost of Federal research and development during 1983 *(Breakdown of item 5C, column 2, of this form)*			
1. Department of Defense	3701		$
2. National Aeronautics and Space Administration	3702		
3. Department of Energy	3703		
4. All other Federal Agencies	3704		
5. TOTAL COST *(Sum of 1, 2, 3, and 4)* →	3799		$

Item 7 – COST OF CONTRACT VALUE OF RESEARCH AND DEVELOPMENT PERFORMED WITHIN THIS COMPANY BY MAJOR TYPE OF EXPENSE	CT1	*Thousands of dollars*	
		1	1983 2
A. Wages and salaries of research and development personnel *(Include scientists and engineers, technicians, secretaries, and other personnel)*	4010		$
B. Costs of materials and supplies consumed (do not include in this item components, models, and other materials supplied by other research organizations)	4020		
C. Other costs (include service and supporting costs, depreciation, and share of overhead)	4030		
D. TOTAL COSTS *(Sum of A through C) (Same as item 5C, column 4)* →	4099		$

Please continue on page 2

Section II – R&D PERFORMED WITHIN THE COMPANY IN THE UNITED STATES – Continued

(Exclude R&D financed by the company but performed by others. Report such R&D in section III.)

Item 8 – FIELDS OF BASIC RESEARCH *(Of the total reported in item 5A for basic research, please give cost for the following fields.)*	CT1	Thousands of dollars 1	Thousands of dollars 1983 2
A. Chemistry	5001		$
B. Engineering (including metallurgy)	5002		
C. Geological sciences	5003		
D. Mathematics	5004		
E. Physics	5005		
F. Astronomy	5006		
G. Atmospheric sciences	5007		
H. Oceanography	5008		
I. Biological sciences	5009		
J. Clinical medical sciences	5010		
K. Other sciences	5011		
L. TOTAL BASIC RESEARCH COST *(Same as item 5A, column 4)* ⟶	5099		$

Item 9 – APPLIED RESEARCH AND DEVELOPMENT BY PRODUCT GROUP *(Of the total reported in item 5B, line 3, for applied research and development, please give cost of project for each of the following. See the instructions on how to classify and define research and development, page 6.)*	CT2	Thousands of dollars 1982 Federal 1	Thousands of dollars 1982 Total 2	Thousands of dollars 1983 Federal 3	Thousands of dollars 1983 Total 4
1. Atomic energy devices *(See instruction Manual, page 6)*					
2. Food and kindred products	6200			$	$
3. Textile mill products	6220				
4. Industrial inorganic and organic chemicals	6281				
5. Plastics materials and synthetic resins, rubber, and fiber	6282				
6. Drugs	6283				
7. Agricultural chemicals	6287				
8. All other chemicals	6289				
9. Petroleum refining	6290				
10. Rubber and miscellaneous plastics products	6300				
11. Stone, clay, glass, and concrete products	6320				
12. Primary ferrous products	6331				
13. Primary and secondary nonferrous metals	6339				
14. Fabricated metal products	6340				
15. Engines and turbines	6351				
16. Farm machinery and equipment	6352				
17. Construction, mining, and materials handling machinery	6353				
18. Metalworking machinery and equipment	6354				
19. Office, computing, and accounting machines	6357				
20. Other machinery, except electrical	6359				
21. Electric transmission and distribution equipment	6361				
22. Electrical industrial apparatus	6362				
23. Radio and television receiving sets, except communication types	6365				
24. Electronic components and accessories, communications equipment	6366				
25. Other electrical machinery equipment and supplies	6369				
26. Missiles	6197				
27. Space vehicles	6198				
28. Aircraft and parts	6372				
29. Motor vehicles and equipment	6371				
30. Other transportation equipment	6379				
31. Professional and scientific instruments	6380				
32. Ordnance, except missiles	6199				
33. Other – Specify ↙	6998				
34. TOTAL APPLIED RESEARCH AND DEVELOPMENT COSTS *(Same as item 5B, line 3, columns 2 and 4)* ⟶	6999			$	$

Item 10 – COST OF RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY, BY STATE

Were all of the research and development costs reported in item 5C, column 4, on this form for 1983 performed in the State listed in the address block (item 1) of this form? . . . . ☐ YES ☐ NO

If "No," list the home State and any other States in which the various research and development laboratories or facilities are located, and estimate the costs associated with each State. If necessary, you may report up to 10 percent of your total as "Not distributed by State."

State *(Attach an additional sheet if necessary)*	CT1	Thousands of dollars 1982 Federal 1	Thousands of dollars 1982 Total 2	Thousands of dollars 1983 Federal 3	Thousands of dollars 1983 Total 4
A.	71			$	$
B.	71				
C.	71				
D.	71				
E.	71				
F.	71				
G.	71				
H.	71				
I.	71				
J.	71				
K.	71				
L.	71				

M.	**71**			
N.	**71**			
O.	**71**			
P.	**71**			
Q.	**71**			
R.	**71**			
S. TOTAL COSTS *(Same as item 5C, on this form)* ⟶	**7199**		$	$

Item 11 — RESEARCH AND DEVELOPMENT BY FUNCTIONAL CATEGORY ***(Of the total reported in item 5C, COSTS OR RECEIPTS FOR RESEARCH AND DEVELOPMENT, columns 2 and 4, report the following functional categories.)***

ENERGY RESEARCH AND DEVELOPMENT
Include the project cost or portion of project cost incurred for the purpose of increasing energy resources or capabilities. Include cost by type of energy.

If "None," please mark ☐ 80996

	CT2	Thousands of dollars				
		1982		1983		1984
		1 Federal funds	2 Total funds	3 Federal funds	4 Total funds	5 Total projected costs
A. Total nuclear	**8010**		$	$	$	$
1. Fission	**8011**					
2. Fusion	**8012**					
B. Total fossil fuels	**8020**					
1. Oil	**8021**					
2. Gas	**8022**					
3. Shale	**8023**					
4. Coal	**8024**					
a. Synthetic fuels	**8025**					
b. Mining	**8026**					
c. All other	**8027**					
5. Other fossil fuels	**8028**					
C. Geothermal	**8030**					
D. Solar	**8040**					
E. Conservation and utilization	**8050**					
F. All other energy	**8060**					
G. Total of A through F ⟶	**8099**	$	$	$	$	$

POLLUTION ABATEMENT RESEARCH AND DEVELOPMENT — Include the project cost or portion of the project cost incurred for the purpose of designing pollution abatement products or product characteristics or of designing pollution abatement features into processes. Include cost by form of pollution to be abated.

If "None," please mark ☐ 81996

	CT2	Thousands of dollars				
		1982		1983		1984
		1 Federal funds	2 Total funds	3 Federal funds	4 Total funds	5 Total projected costs
H. Air	**8110**			$	$	$
1. Automotive emission	**8111**					
2. Electric power plant emissions	**8112**					
3. All other	**8113**					
I. Water	**8120**					
J. Solid waste	**8130**					
K. Other	**8140**					
L. Total of H through K ⟶	**8199**	$	$	$	$	$

Section III — RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE THE DOMESTIC COMPANY *(Not included in item 5) with company funds.*

		Thousands of dollars	
Item 12 — TOTAL COMPANY FUNDS SPENT FOR RESEARCH AND DEVELOPMENT ACTIVITIES PERFORMED OUTSIDE THE COMPANY WITHIN THE UNITED STATES	CT1	1982 1	1983 2
If "None," please mark ☐ 90013	**9001**		$

		Thousands of dollars	
Item 13 — TOTAL COMPANY FUNDS SPENT FOR RESEARCH AND DEVELOPMENT ACTIVITIES PERFORMED BY FOREIGN AFFILIATES OUTSIDE THE UNITED STATES	CT2	1982 1	1983 2
If "None," please mark ☐ 11603	**1160**	$	$

Section IV — RESEARCH AND DEVELOPMENT DISTRIBUTION BY SPECIAL CATEGORIES

		Thousands of dollars	
Item 14 — PRODUCT VERSUS PROCESS APPLIED RESEARCH AND DEVELOPMENT — Allocate the total applied research and development dollar figures of **item 5B3, columns 2 and 3** ("FEDERAL" and "COMPANY") to either **product, process, or Unclassifiable R&D.**	CT1	1982 1	1983 2
A. Product research and development			
1. Federal funds	**1210**		$
2. Company and other funds	**1211**		
3. **Total** *(Sum of 1 and 2)* ⟶	**1212**		
B. Process research and development			
1. Federal funds	**1220**		
2. Company and other funds	**1221**		
3. **Total** *(Sum of 1 and 2)* ⟶	**1222**		
C. Unclassifiable as to product or process			
1. Federal funds	**1230**		
2. Company and other funds	**1231**		
3. **Total** *(Sum of 1 and 2)* ⟶	**1232**		
D. Total *(Sum of A3, B3, and C3)* ⟶	**1299**		$

Please continue on page 3

Section IV — RESEARCH AND DEVELOPMENT DISTRIBUTION BY SPECIAL CATEGORIES — Continued

Item 15 — TOTAL COMPANY FUNDS (Exclude Federal) spent for research and development activities performed **to meet the present regulations** of the agencies listed below, and which would not have been performed in the absence of these regulations. **Include** expenditures to meet Government regulations which have been established but which have a future compliance date. **Exclude** expenditures to meet **anticipated** Government regulations.

	CT1	Thousands of dollars	
IF NONE, MARK (X) ——→ ☐13000		1	**1983** 2
A. Consumer Product Safety Commission	**1310**		$
B. Department of Energy	**1311**		
C. Environmental Protection Agency	**1312**		
D. Federal Aviation Administration	**1313**		
E. Federal Communications Commission	**1314**		
F. Food and Drug Administration	**1315**		
G. National Highway Traffic Safety Administration	**1316**		
H. Nuclear Regulatory Commission	**1317**		
I. Occupational Safety and Health Administration	**1318**		
J. Other Federal agencies — *Specify*	**1319**		
	1320		
	1321		
	1322		
K. State and local governments	**1323**		
L. Other — *Specify*	**1324**		
	1325		
	1326		
M. TOTAL *(Sum of A through L)* ——→	**1399**		$

Item 16 — LONG VERSUS SHORT TERM RESEARCH DEVELOPMENT COSTS

Allocate the total R&D dollar figures of item 5C, columns 2 and 3 ("FEDERAL" and "COMPANY"), based on the actual or estimated future life of each of your projects in the R&D cycle, into the following three categories.

	CT1	Thousands of dollars			
		FEDERAL		COMPANY	
		1	**1983** 2	3	**1983** 4
A. Less than or equal to 2-year project life in R&D	**1410**		$		$
B. More than 2-year but less than or equal to 5-year project life in R&D	**1420**		$		$
C. More than 5-year project life in R&D	**1430**		$		$

REMARKS

Name of person to contact regarding this report	Address *(No. and street, city, State, ZIP code)*	Telephone — Area code	Telephone — Number	Telephone — Extension

CERTIFICATION — This report is substantially accurate and has been prepared in accordance with instructions.

Name of company	Address *(No. and street, city, State, ZIP code)*	
Signature of authorized official	**Title**	**Date**

DUE DATE: 60 DAYS AFTER RECEIPT OF FORM O.M.B. No. 3145-0027: Approval Expires July 31, 1984

FORM **RD-1A**
(8-31-83)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1983

RETURN TO
Bureau of the Census
1201 East Tenth Street
Jeffersonville, Indiana 47132

NOTICE — Your report to the Census Bureau is **confidential** by law (title 13, U.S. Code). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are **immune from legal process.**

GENERAL INSTRUCTIONS

Please complete and return this form in the envelope provided within 60 days. Retain the file copy for your records. This report should cover your entire company, including all subsidiaries and affiliates, unless otherwise designated.

Enter "None" where appropriate rather than leaving a blank space.

Reasonably accurate estimates are acceptable.

PLEASE READ INSTRUCTIONS AND DEFINITIONS ON REVERSE SIDE BEFORE COMPLETING THIS FORM.

Item 1 — NAME AND ADDRESS OF COMPANY — *Please correct any error in name and address, including ZIP code*

Group	Survey
4	4001

YOUR FILE COPY

CENSUS USE ONLY	1	2	3	4	5	6

Data supplied in item 2 and in item 4A, columns 2 and 4, for 1983 on this form will satisfy the mandatory reporting requirement of Census Form MA-121 (title 13, U.S. Code).

Item 2 — SALES AND EMPLOYMENT FOR COMPANY	**C. T. 1**	**1983**
		Thousands of dollars
A. Domestic net sales of all products (or receipts for service)	**2001**	2 $
		Number
B. Total domestic company employment in all activities during the pay period which includes the 12th of March 1983	**2002**	2

Item 3 — NUMBER OF RESEARCH AND DEVELOPMENT SCIENTISTS AND ENGINEERS ***(See instructions on reverse side)***	**C. T. 2**	**January 1984**
	3099	2

Item 4 — COST OR RECEIPTS FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY	**C. T. 2**	***Thousands of dollars***			
		1	2 Federal funds	3 Company and other funds, except Federal	4 **TOTAL** *(Sum of columns 2 and 3)*
A. 1983 TOTALS	**3599**	▨	$	$	$
B. Company and other funds, except Federal, bugeted for the year 1984	**C. T.1** **3800**			1 $	▨

Item 5 — TOTAL COMPANY FUNDS SPENT FOR RESEARCH AND DEVELOPMENT ACTIVITIES PERFORMED OUTSIDE THE COMPANY BUT WITHIN THE UNITED STATES	**C. T.1**	**1983**
	9001	2 $

Item 6 — STATUS OF THIS COMPANY ON DECEMBER 31, 1983

A. Was the company listed in item 1 owned or controlled by another company on December 31, 1983? ☐ Yes — *Complete item 6B* ☐ No

B. New owner information

Name			Date acquired
Address *(Number and street)*			Federal Social Security Employer Identification Number, if available
City	State	ZIP code	

Please continue on reverse →

INSTRUCTIONS AND DEFINITIONS FOR SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1983

General Instructions — Figures reported on sales and employment (items 2A and B) should cover your entire company, including all subsidiaries and affiliates, unless otherwise designated. The sales figures should exclude excise taxes and other discounts and allowances such as freight charges. The cost figure reported should cover the calendar years if at all possible. Please report your employment data (items 2B and 3) for the period prescribed on this report form.

Geographic Area Covered — The data are intended to relate to business firms in the fields of manufacturing, minerals, and other economic areas which operate one or more establishments in one or more of the 50 States or the District of Columbia.

Scientists and Engineers — Scientists and engineers for this survey are defined as all persons engaged in scientific or engineering work at a level which requires a knowledge of physical or life sciences or engineering or mathematics equivalent at least to that acquired through completion of a 4-year college course with a major in these fields, regardless of whether they held a college degree in the field.

Report the number assigned to research and development. If the scientists and engineers work on research and development and other activities, the figure reported should be based on the proportion of the total time that is devoted to research and development.

Research and Development — Research-development includes basic and applied research in the sciences (including medicine) and in engineering, and design and development of prototype products and processes. It does not include quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, or other nontechnological activities or technical service.

Cost of Research and Development Work Performed Within the Company — All costs incurred within the company for wages and salaries, direct material costs, services and supporting costs, and an appropriate share of company overhead to conduct research and development activities. If you did research and development for others, include the total amount charged for such work.

Under Federal funds, include research and development in procurement as well as research and development contracts and research and development subcontracts. Exclude research and development subcontracted to others.

If the company has a separate research-development organization, please exclude the estimated cost of any nonresearch-development activities conducted by that unit; include the approximate cost of research-development activities of company laboratories of technical groups not part of the research organization.

Company Funds Spent in Research and Development Done Outside Your Company — Include in this item payments, in the form of contracts, grants, fellowships, etc., made to commercial laboratories and consultants, educational institutions, hospitals, and research institutions for research and development activities. Please do not include subcontracting of Federal Government contracts or contracts received from other companies. (To do so would cause duplication in the total figure for the survey.)

If you have questions regarding reporting problems on this form, please write to the Bureau of the Census, Industry Division, Washington, D.C. 20233 or call Area Code (301) 763-5598.

Remarks

Item 7 — CERTIFICATION — This report is substantially accurate and has been prepared in accordance with instructions.

Name of person to contact regarding this report		Telephone *(Area code, number, extension)*
Address *(Number and street, city, State, ZIP code)*		
Name of company		
Address *(Number and street, city, State, ZIP code)*		
Signature of authorized official	Title	Date

FORM RD-1A (8-31-83)

DUE DATE: 15 DAYS AFTER RECEIPT OF FORM

O.M.B. No. 3145-0027: Approval Expires July 31, 1984

FORM **MA-121**
(7-29-83)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

COMPANY SUMMARY OF RESEARCH AND DEVELOPMENT

1983

NOTICE — Response to this inquiry **is required by law (title 13, U.S. Code,** sections 131, 182, 224, and 225). By section 9 of the same law, your report to the Census Bureau is **confidential**. It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are **immune from legal process.**

(Please correct any error in name and address including ZIP code)

Group	Survey
4	9901

RETURN TO

Bureau of the Census
ATTN: Industry Division
Washington, D.C. 20233

Please complete and return this form in the return envelope not later than 15 days after you receive it. Companies with no research and development expenditures should so state in the "Remarks" section, fill in items 1a and 1b, sign, and return the form.

YOUR FILE COPY

PLEASE READ INSTRUCTIONS ON REVERSE SIDE BEFORE COMPLETING YOUR REPORT

Item 1 — SALES AND EMPLOYMENT FOR COMPANY	C.T.1	*(Thousands of dollars)*
a. Net sales and receipts of this company and its subsidiaries during 1983	2001	$
		Number of employees
b. Number of employees in this company in all activities in the 50 States and the District of Columbia during the pay period which includes the 12th of March 1983	2002	

		1983 *(Thousands of dollars)*		
	C.T.2	Federal funds 1	Company and other funds, except Federal 2	TOTAL *(Sum of columns 1 and 2)* 3
Item 2 — COST OR RECEIPTS FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY DURING 1983	3599	$	$	$

Remarks

Name of person to contact regarding this report	Address *(Number and street, city, State, ZIP code)*	Telephone *(Area code, number, extension)*

CERTIFICATION — This report is substantially accurate and has been prepared in accordance with instructions.

Name of company	Address *(Number and street, city, State, ZIP code)*	
Signature of authorized official	Title	Date

GENERAL INSTRUCTIONS

A report should be filed by each company receiving a copy of this form. If your company does not conduct research and development, so state in remarks, fill in items 1a and 1b, sign, and return the form. If you have questions regarding reporting problems on this form, please write to the Bureau of the Census, Industry Division, Washington, D.C. 20233.

Report for your entire company — Research and development activities for your entire domestic company should be reported.

Period covered by report — The cost figure reported should cover the calendar year if at all possible. However, fiscal year data are acceptable, provided your fiscal year ends between September and March.

DEFINITION OF RESEARCH AND DEVELOPMENT

Research-development includes basic and applied research in the sciences (including medicine) and in engineering, and design and development of prototypes, products, and processes. It does not include quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, or other nontechnological activities or technical services.

SPECIFIC INSTRUCTIONS BY ITEM

Item 1 — Sales and Employment for Company. In item 1a, report the net billings of this company and its subsidiaries to customers outside the company. (Exclude domestic intra-company transfers and sales by foreign subsidiaries. Include the transfers to such foreign subsidiaries, however.) In item 1b, report the number of persons employed by the company in all activities in the 50 States and the District of Columbia during the pay period which includes the 12th of March 1983.

This figure would be the same as that shown by the company in item 1 of Treasury Form 941, if the company filed one form 941 for the entire company.

Item 2 — Show all costs incurred within the company for wages and salaries, direct material costs, services and supporting costs, and an appropriate share of company overhead to conduct research and development activities.

Under Federal funds, include research and development in procurement as well as research and development contracts and research and development subcontracts. Exclude research and development subcontracted to others.

Remarks (Continued)